Introduction

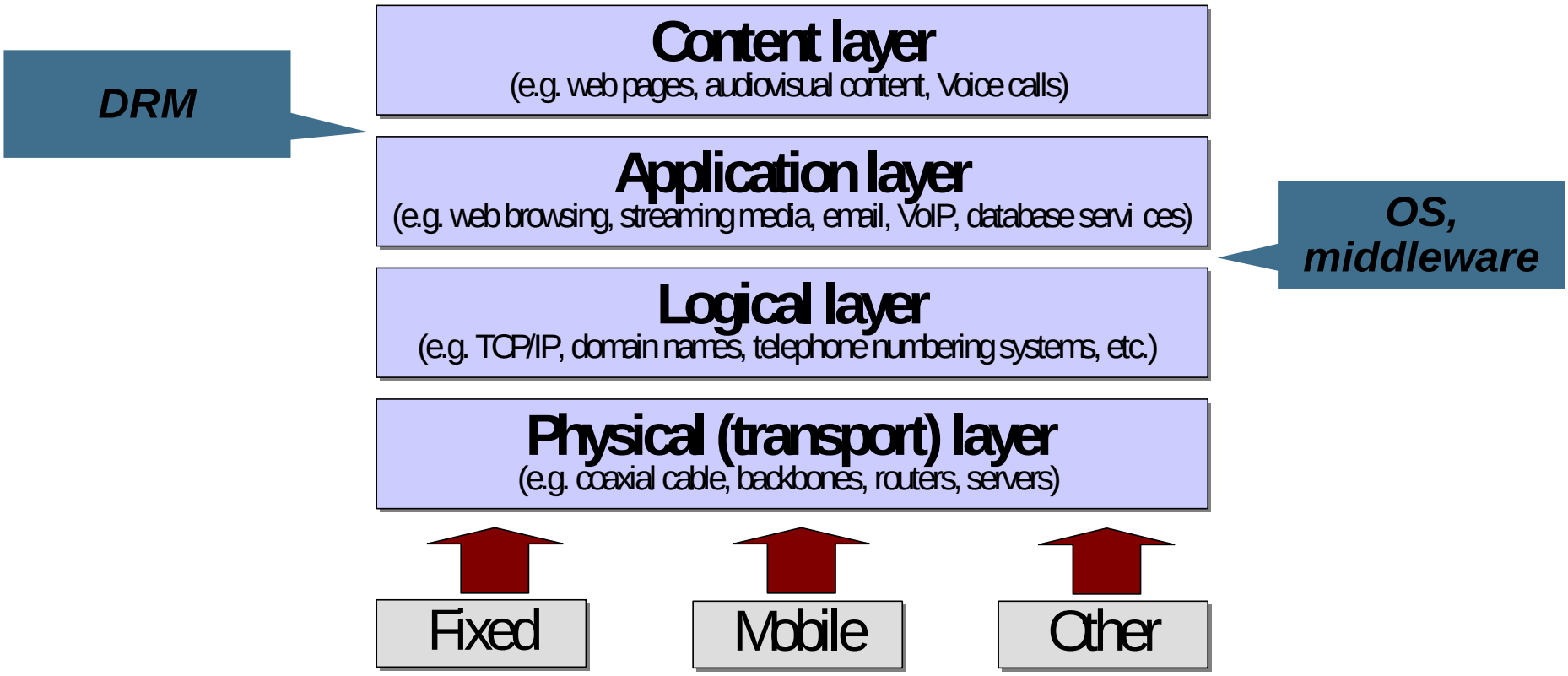
The Present and Future of Internet Policy

Bangkok, 3 May 2016

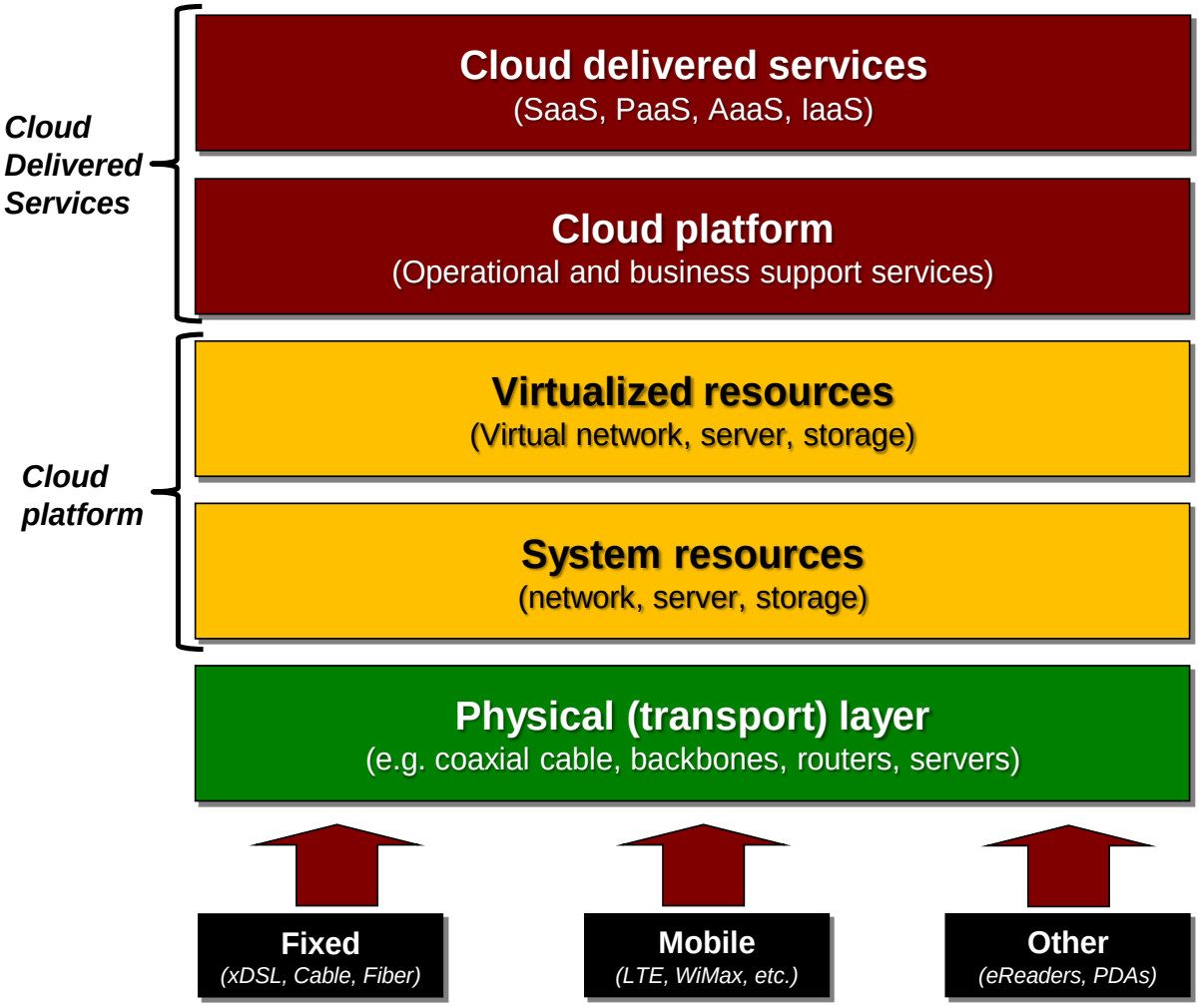
The project

- **Based on an ongoing research cooperation between CEPS and the NBTC, started in 2015**
- **Saw the active participation of four high level experts with extensive expertise in the field of telecoms and Internet policy (Bohlin, Forge, Renda, Yoo).**
- **Project is coordinated and led by Andrea Renda, Senior Research Fellow, CEPS**
- **Aim is to transfer knowledge on existing trends in Internet policy and provide recommendations for Thailand**

Understanding the ICT ecosystem



Understanding the ICT ecosystem



The seminar

- **From infrastructure to services and consumers**
  - **Today: fixed and wireless infrastructure**
  - **Tomorrow: neutrality, privacy, cybersecurity and beyond**
- **Both present and future regulation**
  - **Emphasis on regulatory approaches, especially in the face of breath-taking innovation**
  - **Tomorrow, we try to look at the next decade to discuss the role of policy and regulation in the age of the IoT and pervasive algorithms**
  - **Away from "textbook" regulation**
- **Policy recommendations**
  - **We discuss them in the context of the seminar's wrap-up sessions, both today and tomorrow**

Session 1

Fixed infrastructure: regulation and policy

Bangkok, 3 May 2016

Fixed Infrastructure: Regulation and Policy

Christopher S. Yoo

University of Pennsylvania Law School

May 3, 2016

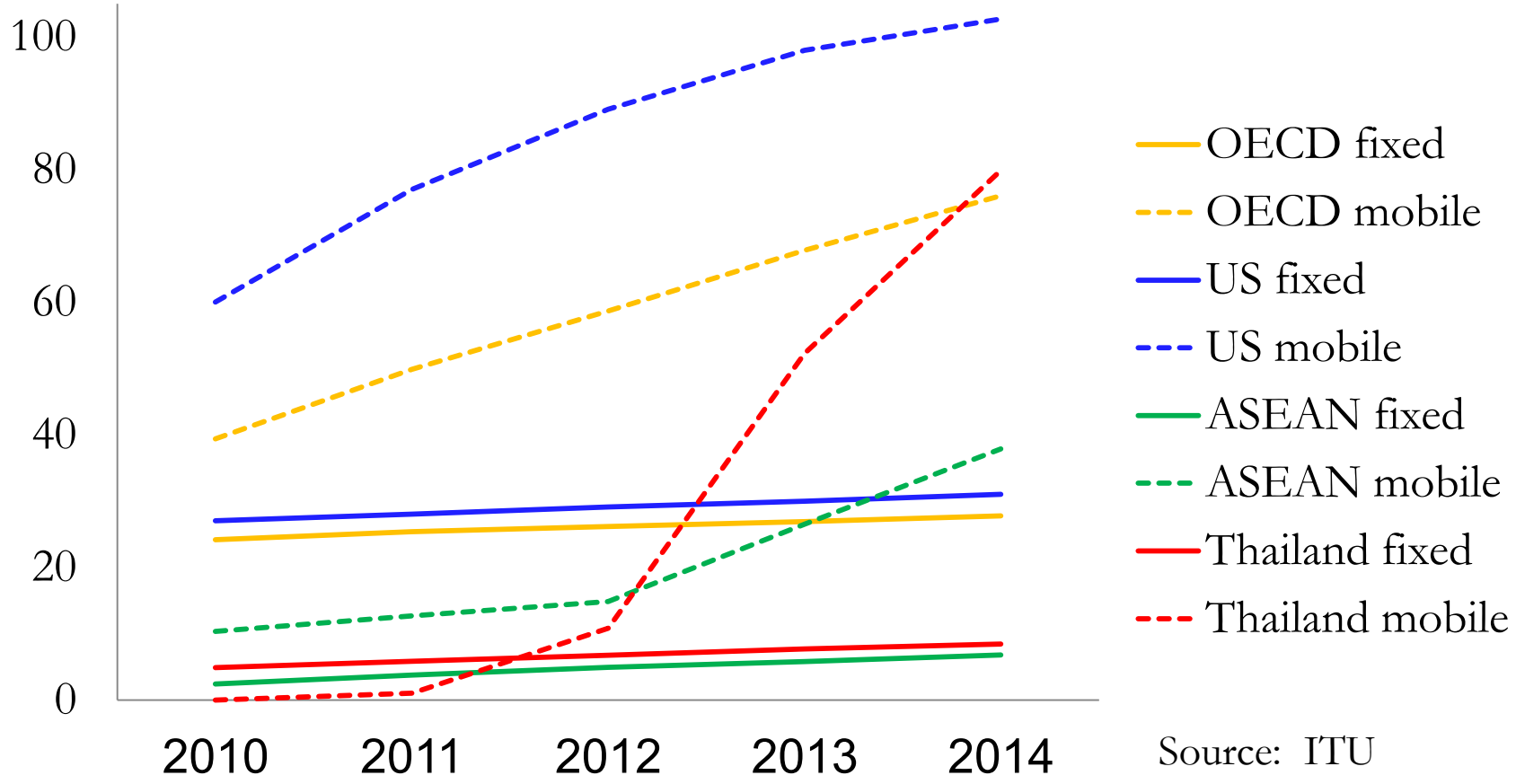
Overview

- The importance of broadband
- The prevalence of mobile broadband and DSL
- Download speeds in Thailand
- Modes of promoting investment: infrastructure sharing, public funding, facilities-based competition
- The role of public-private partnerships, co-investment, and universal service funding
- The importance of the demand side

Broadband as a Driver of Economic Growth

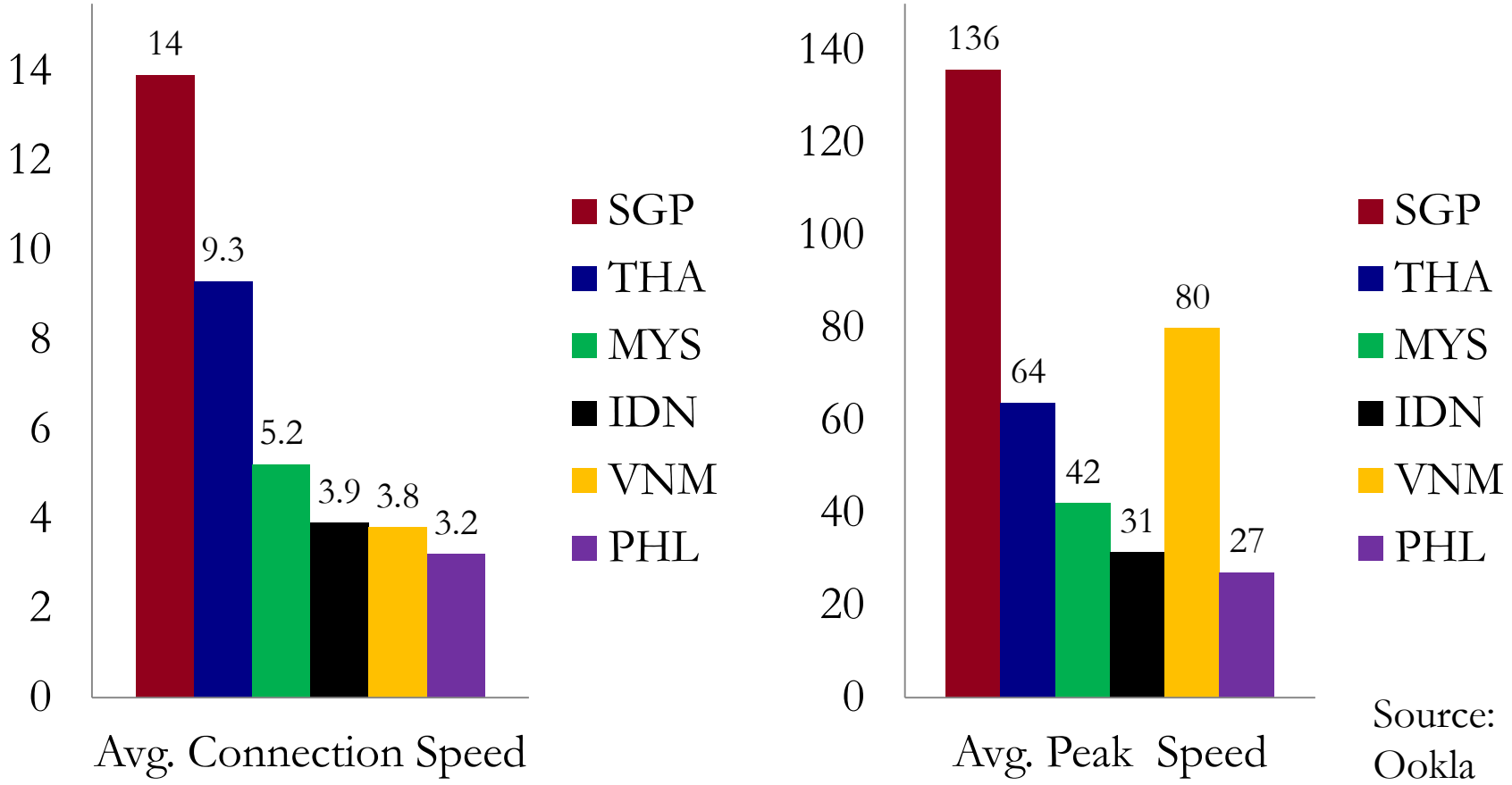
- ITU: 10% increase in broadband penetration increases economic growth by 0.25%-1.4%
- Thailand faces some challenges
  - 34% urbanization
  - 34% computer ownership
  - Relatively small footprint of cable television
  - Need for investments to extend the fixed broadband network and to deploy LTE

Fixed and Mobile Subscriptions per 100 Inhabitants

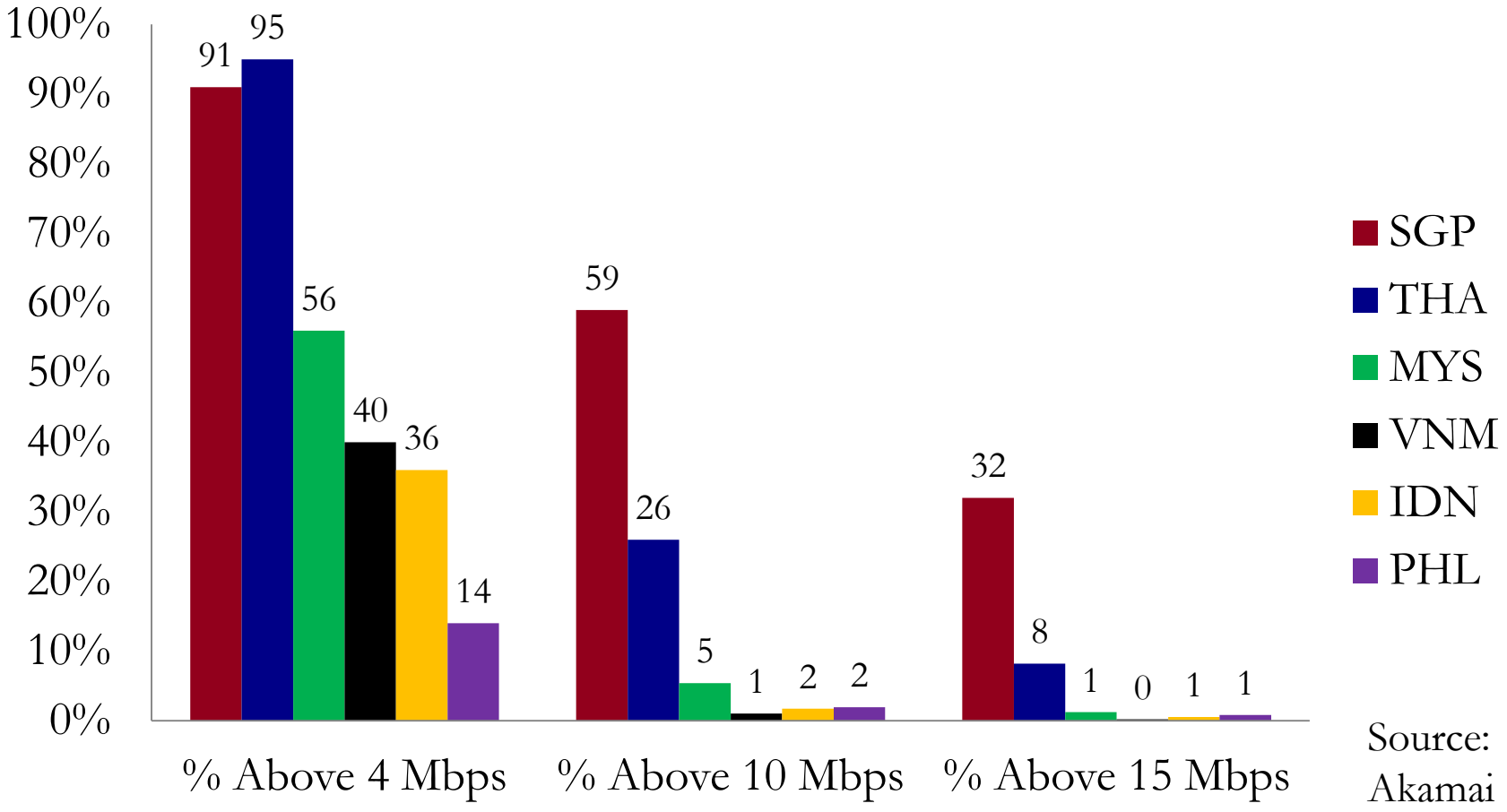


Source: ITU

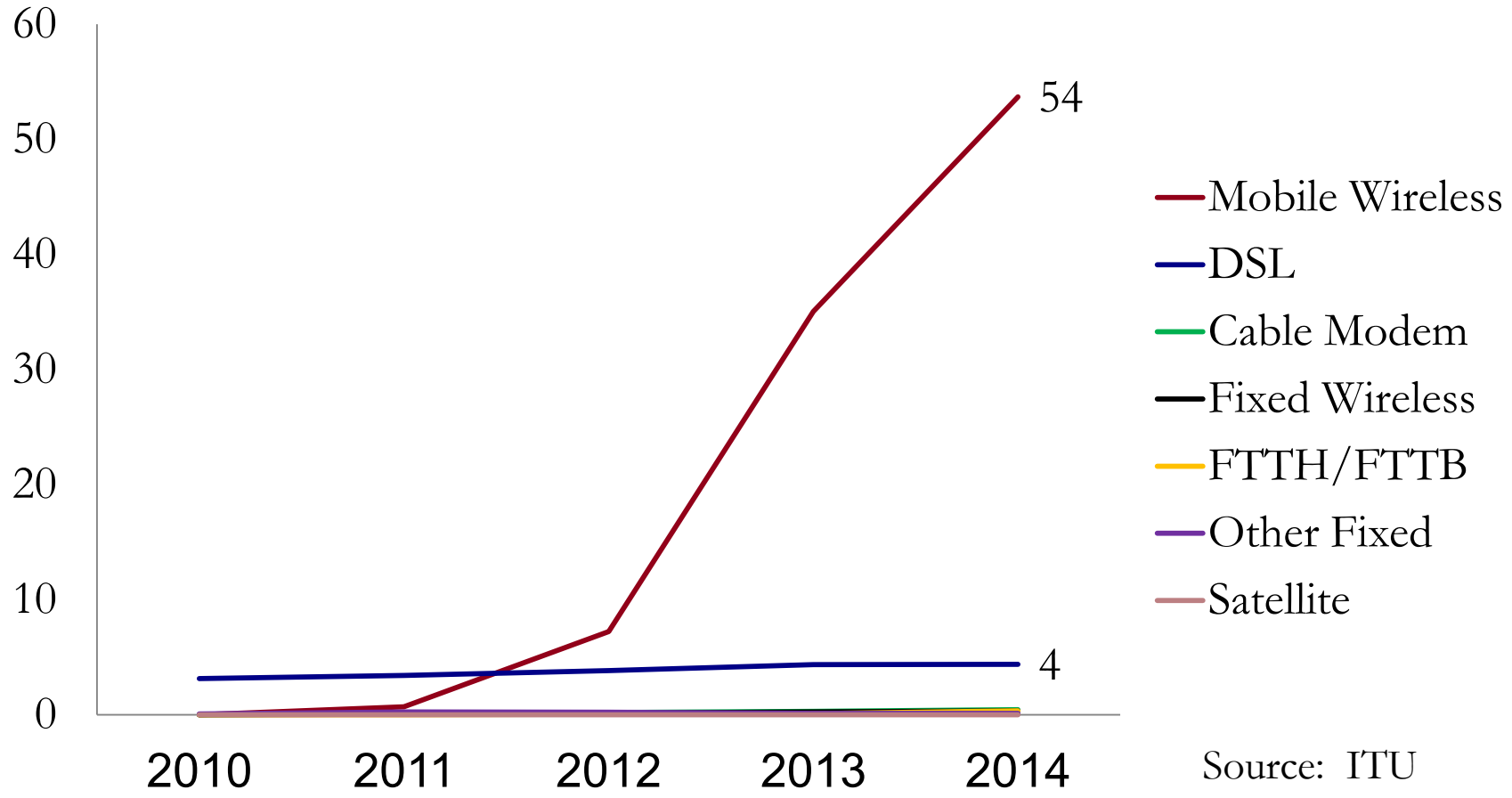
Download Speeds in ASEAN Countries (Mbps)



Percentage of Connections with Given Average Download Speeds



Subscribers in Thailand by Broadband Technology (millions)



Source: ITU

The Role of Fixed Broadband

- Strength in DSL may support VDSL or G.fast
- Mobile broadband subscriptions far exceed fixed broadband subscriptions in Thailand
- 3G is already available to 97% of the population
- Globally, many subscribers are relying exclusively on mobile broadband
- Restrictions on download speeds and pricing for mobile may preserve a role for fixed broadband
- All services need backhaul

Strategies for Promoting Fixed Broadband

- Infrastructure sharing/wholesale access regulation
- Public funding
- Facilities-based competition

Wholesale Access Regulation

- Basic theory: mandate access to parts of the network that remain natural monopolies
- Multiple levels: resale, bitstream access, local loop unbundling – compete by squeezing margins
  - May promote penetration, but deters investment
  - Empirical studies corroborate the deterrence of investment
- Alternative theory: ladder of investment (Cave, 2006)
  - Assumes that companies will use wholesale access as a stepping stone to full facilities-based competition
  - Empirical evidence contradicts (Bacache et al., 2014)

Public Funding

- Direct public funding has proven problematic (NBN in Australia, municipal fiber in the U.S.)
- New approaches
  - Public-private partnerships
  - Co-investment

Public-Private Partnerships (PPP)

- Four modes in the EU (EPEC 2012)
  - Private design, build and operate – private ownership possibly with public financial support
  - Joint venture – joint ownership of project
  - Public outsourcing – full public ownership and funding; complete operation by private sector
  - Public design, build and operate – full public ownership and operation

Co-Investment (risk-sharing model)

- Method to reduce the financial constraint problem and gain more investment (and share risk)
  - Risk-sharing model can generate greater consumer welfare than using traditional wholesale access pricing (Nitsche and Wiethaus 2011)
  - Co-investment can prevent an infrastructure duplication
- Two main approaches to co-investment
  - Joint venture
  - Long-term cooperation agreement

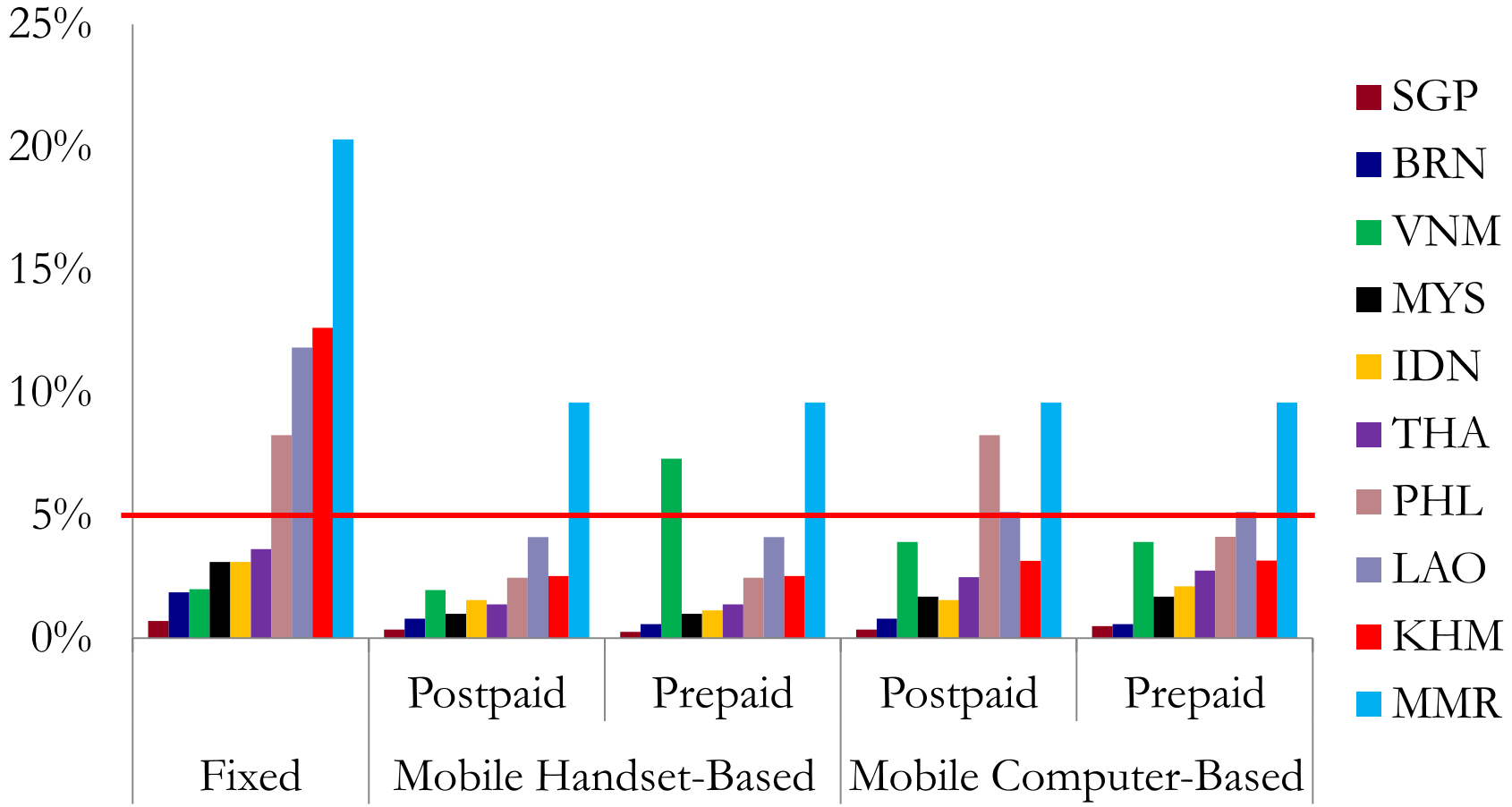
Pros and Cons of PPP and Co-Investment

Modes	Advantages	Disadvantages
Public-private partnership (PPP)	- Reducing digital divide by expanding the coverage to the rural areas - Since monitoring by public sector, the wholesale network is likely to be accessible	- In some cases, the participation by public sector can distort the market. Also, state aids and subsidies, if needed, should be carefully used
Co-investment	- Encouraging small operators to invest and participate in broadband and high-speed broadband market, which ultimately create greater competition in the market - Encouraging operators to provide higher geographical coverage	- If the numbers of companies in the partnership and the numbers of other operators in the market are low, there are greater chances of collusive behavior - In joint venture case, a joint venture company is likely to operate as one company; hence, the monopoly situation can be greater

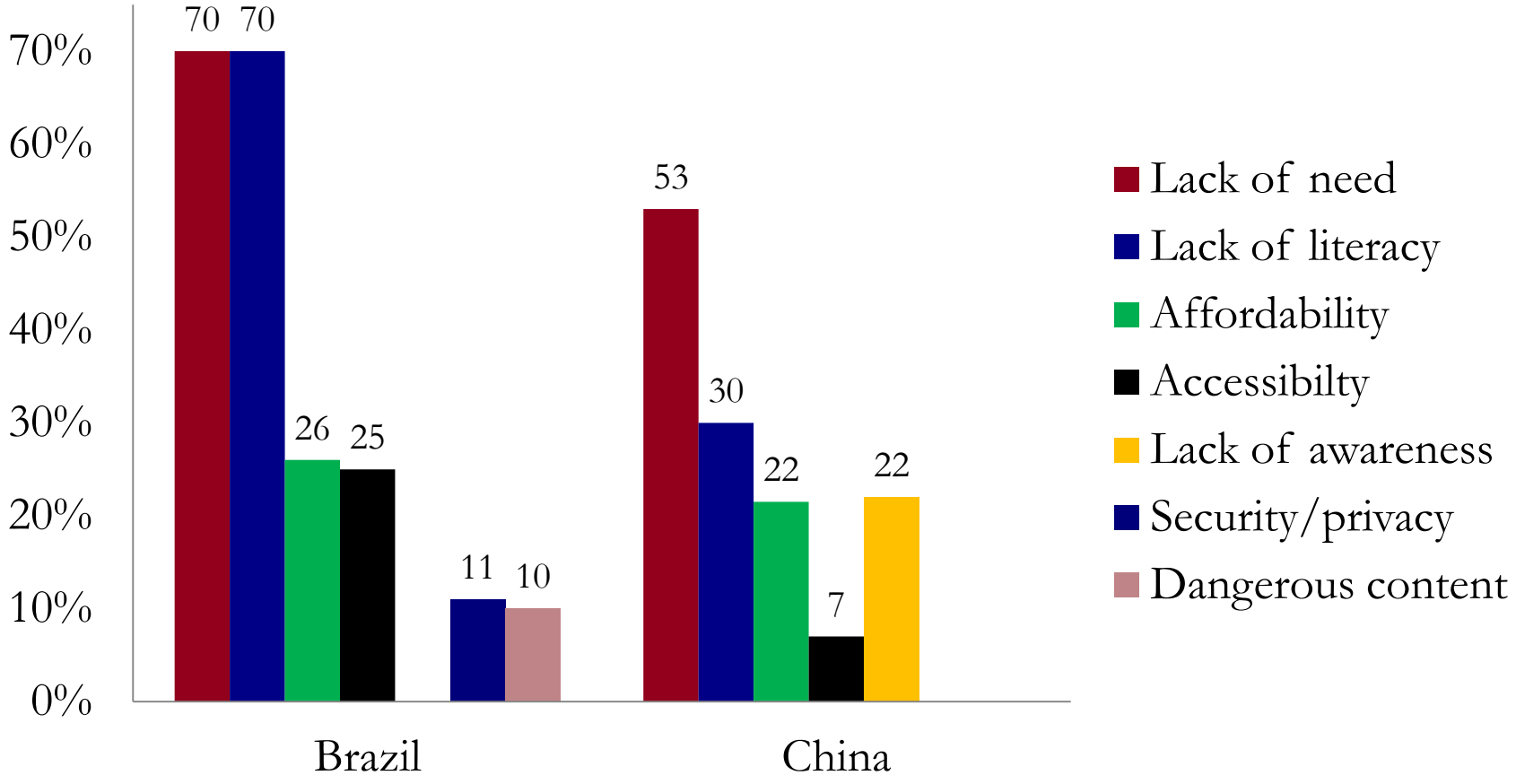
Possibility of Extending Univresal Service to Braodband

- Practice
  - US and Israel yes, Japan and Korea no
  - EU is considering, although some member states have extended universal service to broadband
- Academia divided
  - Beneficial: Teppayayon and Bohlin (2009) and Nucciarelli et al. (2014).
  - Alternatives (such as PPP, co-investment) are preferable (Blackman and Forge, 2008; Falch and Henten, 2009).

Affordability – Monthly Cost as Pct. of Gross National Income Per Capita



Reasons for Nonadoption



Conclusions

- Policy has to adjust to local conditions
  - Obstacles to broadband
  - Potential reliance on mobile
- The importance of driving investment
  - Facilities-based competition
  - Public-private partnerships, co-investment, universal service
- The need to address for demand-side barriers to adoption

Session 2

Mobile markets and policies: policies for roaming and MVNOs

Bangkok, 3 May 2016

Does a cross-region call (eg in one region) really cost so much more than a DOMESTIC national call for voice or data?

Domestic Charge

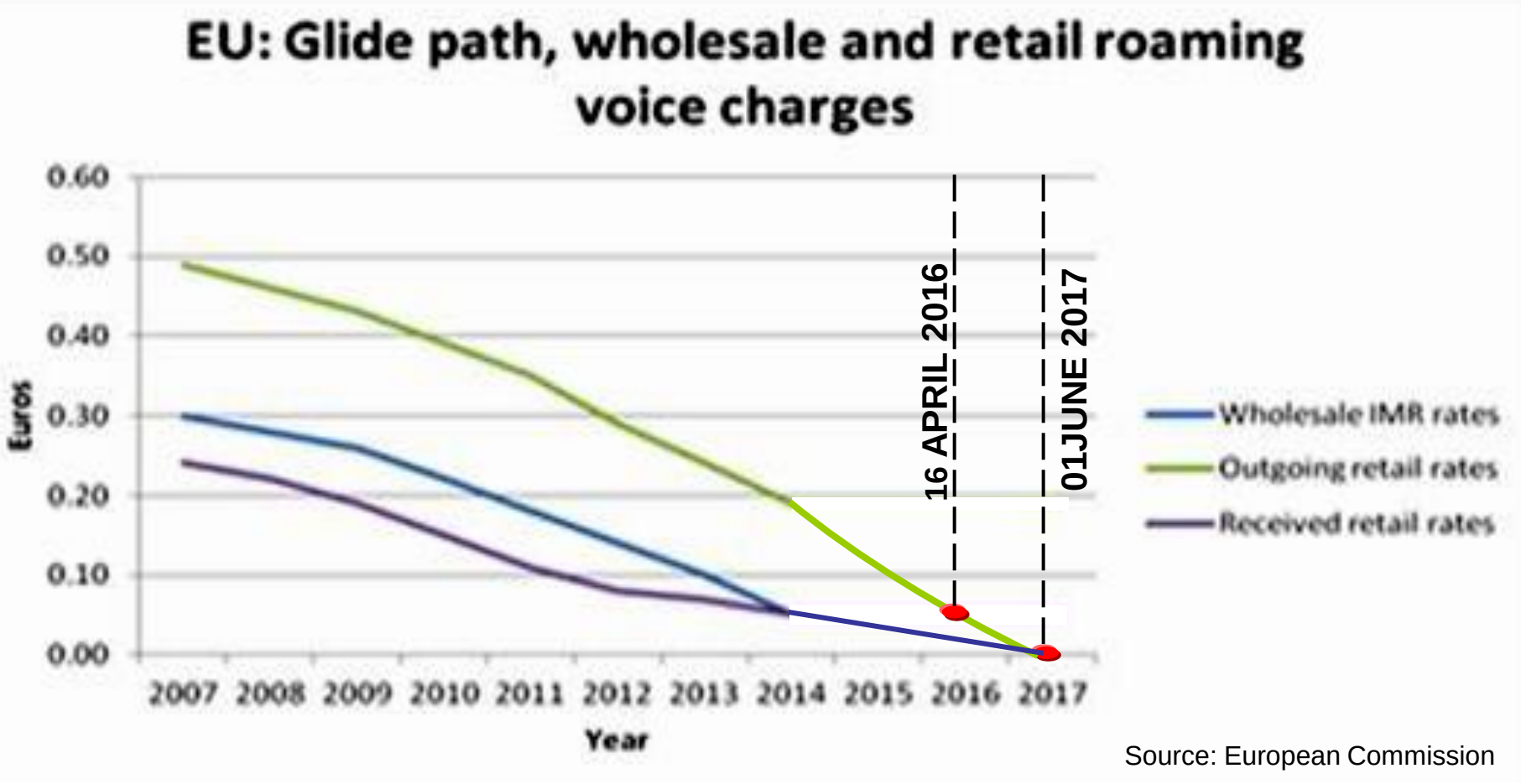
•calling party pays

Roaming Charge

- Up to 4 times domestic or more
- BOTH calling and called party pay

EU Roaming – a 10 year history of moving towards cost-oriented pricing for International Mobile Roaming (IMR)

- Retail Roaming surcharges on outgoing voice calls lowered 16 **APRIL 2016** to 0.05 Euro/min while data surcharge capped at 0.05 Euro/ megabyte of data
- **Roaming surcharges to end 01JUNE 2017**, for 'reasonable use' – at domestic rate (RLAH)



Source: European Commission

EU roaming proposals from SEPT 2013 set the scene

For intra - EU roaming, EC proposals (Sept. 2013) were :-

- Remove incoming call payments from 01July 2014 – not achieved
- Outbound, mobile-to-mobile calls capped at €0.19/minute + VAT
- Target - phase out roaming charges altogether in 2016 – only in 2017
- BUT MNOs largely free of European roaming regulation, if they extend their domestic bundles from 2014 so that by 2018 at latest, customers charged at domestic rates for voice and data - EC accelerated this to June 2017
- MNOs have a choice, either:-

1) Offer plans that apply everywhere in the European Union ("roam like at home“ RLAH) with prices driven by domestic competition,

or

2) Permit customers to “decouple”: ie opt for a separate roaming provider who offers cheaper rates (without buying new SIM card).

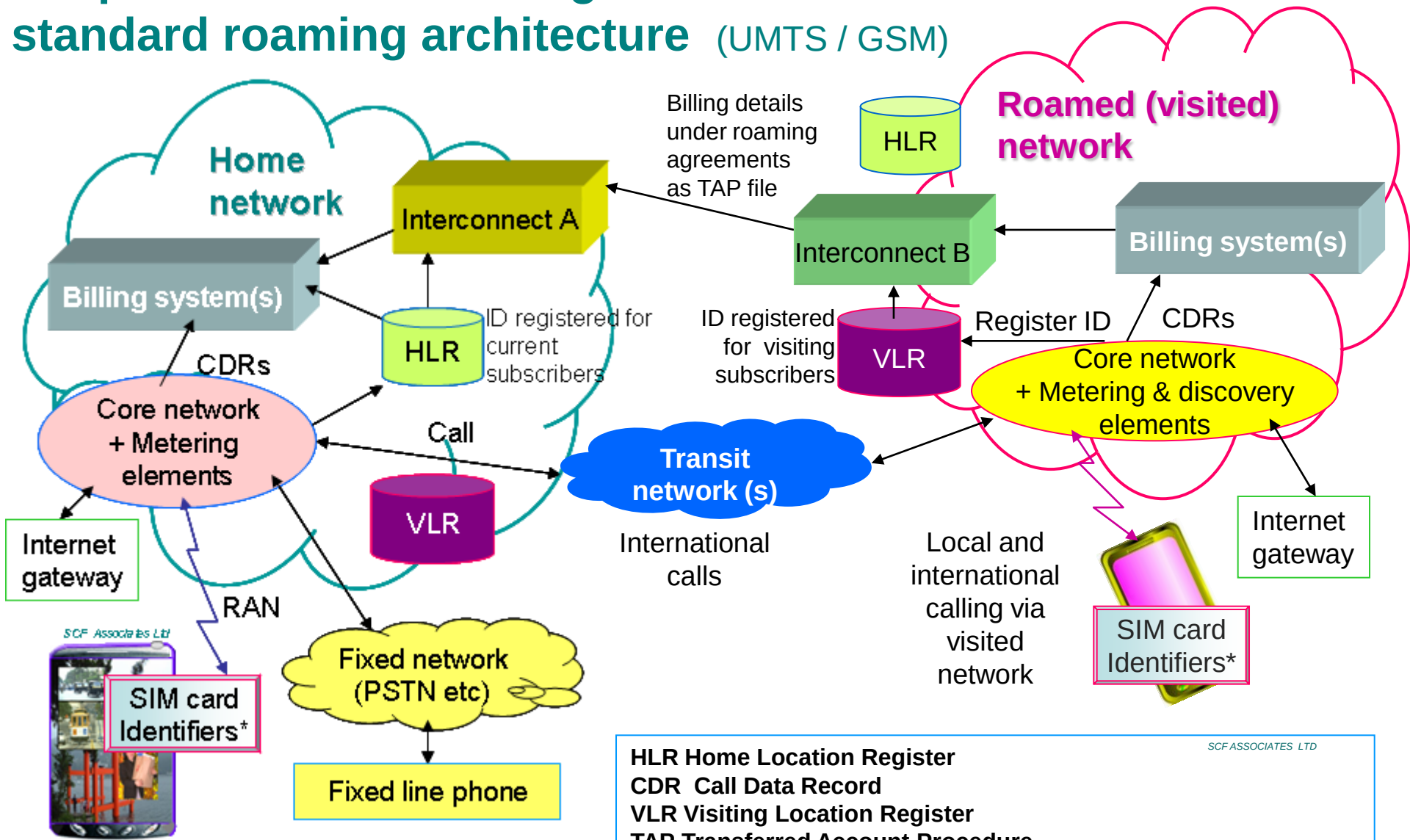
Final objectives globally: tariffs for roaming like a local

- Airtel (ex-Zain): One Network, beginning in 2006, eliminated IMR charges for its customers covering 16 African countries (customers paid domestic rates for outbound roaming calls and not charged for incoming calls; Can use visited network recharge cards)
- Conditions: Airtel – incoming calls free (up to 100 minutes) for 20 countries; outgoing calls at local rates +30% markup (exchange rates)
- MTN One World - Send/receive SMS and browse/use data at a unified call rate while visiting countries where MTN operates
- Vodacom - One Africa Family: free incoming calls in 10 African countries and default rate when roaming on Vodacom networks
- Extra roaming charges questioned when subscribers offered unlimited calls on flat subscription (eg the operator 'Free' in France offers EUR19.90 unlimited domestic calls to 100 countries)?
- In late 2013, T-Mobile USA launched flat rate international calling at 20 US cent/ minute voice for over 100 countries + flat rate SMS and data.

Development of cost model

-the basis of roaming costs in the MNO

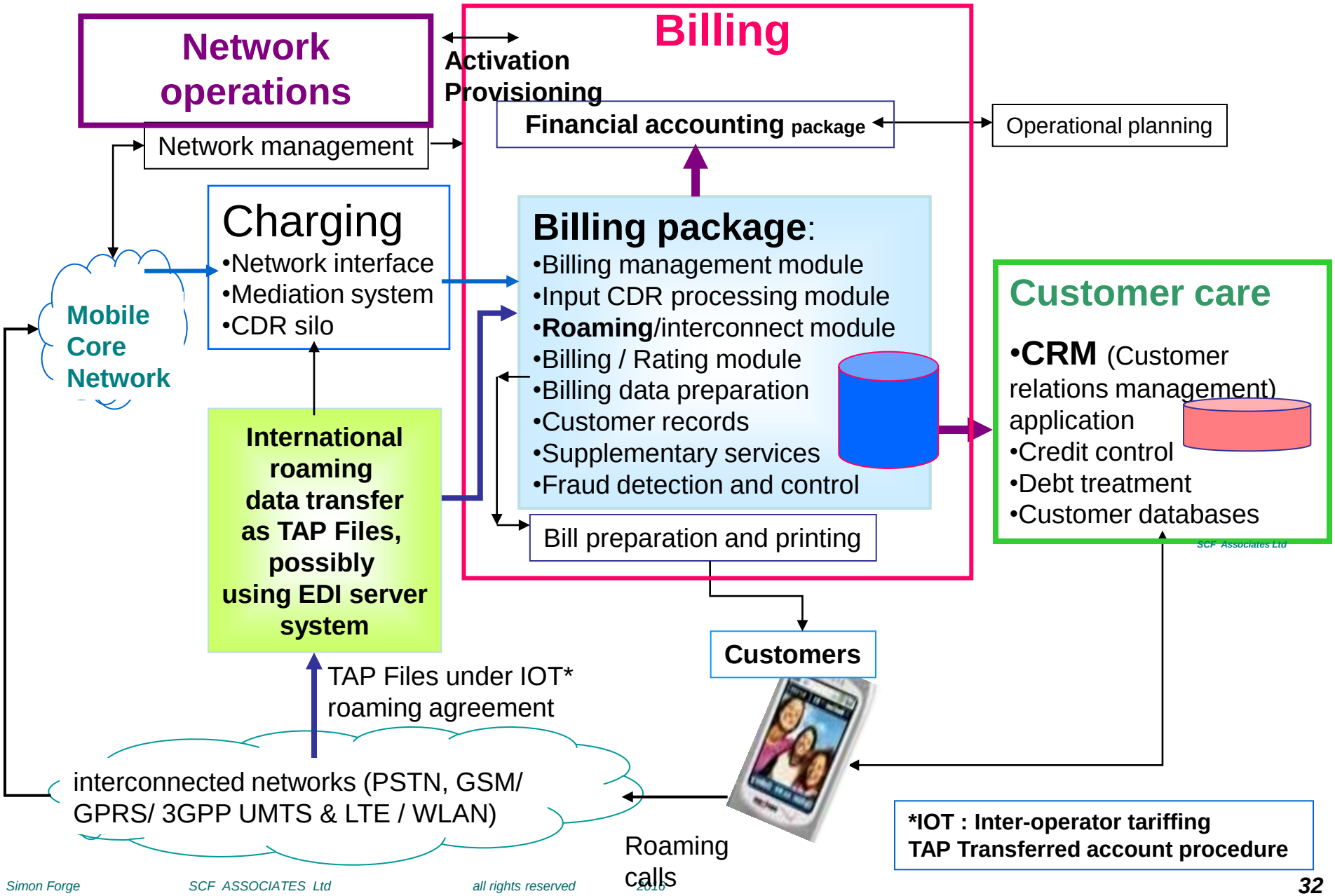
Simplified mobile roaming infrastructure follows standard roaming architecture (UMTS / GSM)



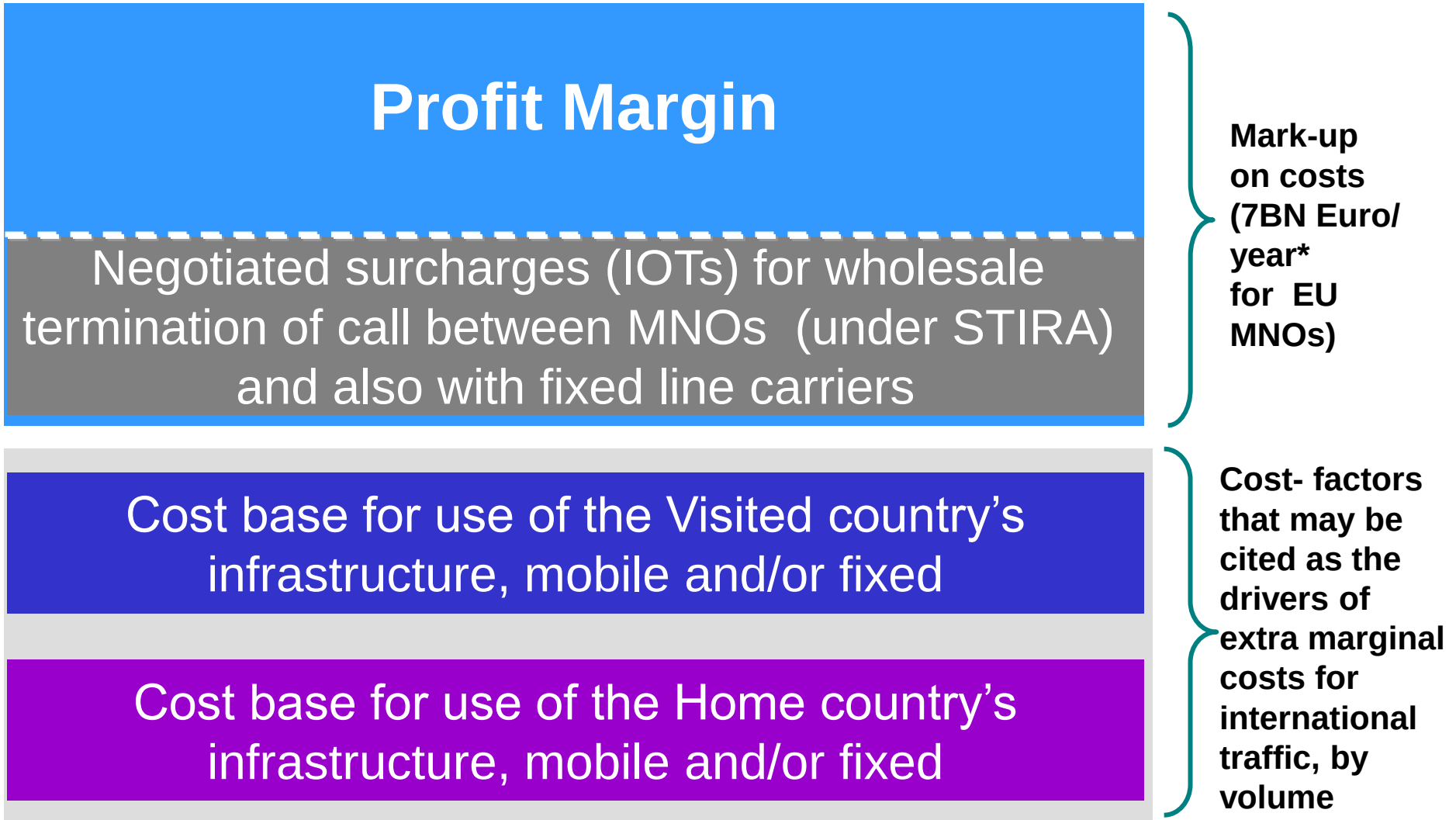
SCF ASSOCIATES LTD

HLR Home Location Register
CDR Call Data Record
VLR Visiting Location Register
TAP Transferred Account Procedure
SIM Subscriber Identification Module
*** Specifically IMSI - International mobile subscriber identifier**

Inside each MNO – there are the charging, billing and customer care business processes in the BSS



The financial structure for MNO roaming tariffs

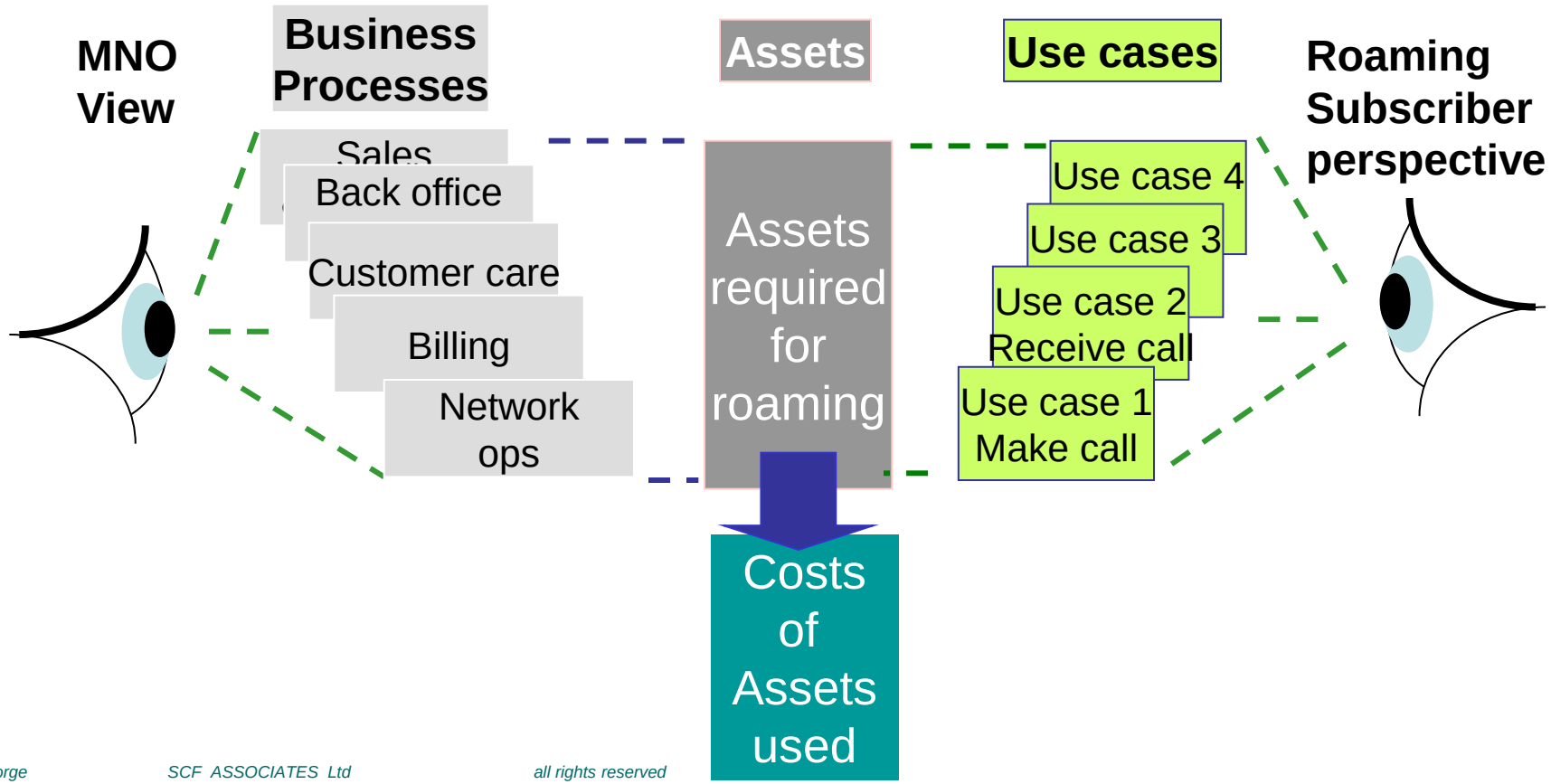


*MNO estimates from Orange, Vodafone, O2, 12 Sep 2013

STIRA – *Standard Terms for International Roaming Agreements* IOT- *Inter-Operator Tariff* MTR *-Mobile Termination Rate*

The basis of the cost model : defining what roaming demands via USE CASES drawn from actual behaviour:-

- **To define the business processes, with staff and support infrastructure with its software / hardware**
- **And therefore to identify the cost structures of IMR services with the elements,**



International roaming involves the following cost centres
which are extensions of the existing domestic network operational systems

Roaming costs should be just an additional *fraction* of domestic costs

Major cost centres

IOTs - Wholesale Roaming agreements with each MNO & FNO for origination, carriage & termination (negotiation and payments)

Operational business processes for roaming and their support systems

Network Equipment Capex (Gateways, VLR, mediation, cabling, NOC etc, procure/extend)

Network Equipment Opex (Salaries, NOC, Maintenance, Site rents, etc)

Business Support Services Capex (Billing & customer care Software & h/w, Data centre)

Business Support Services Opex (Processes operation, S/w licences, Salaries, Maintenance, Data centre overheads, etc)

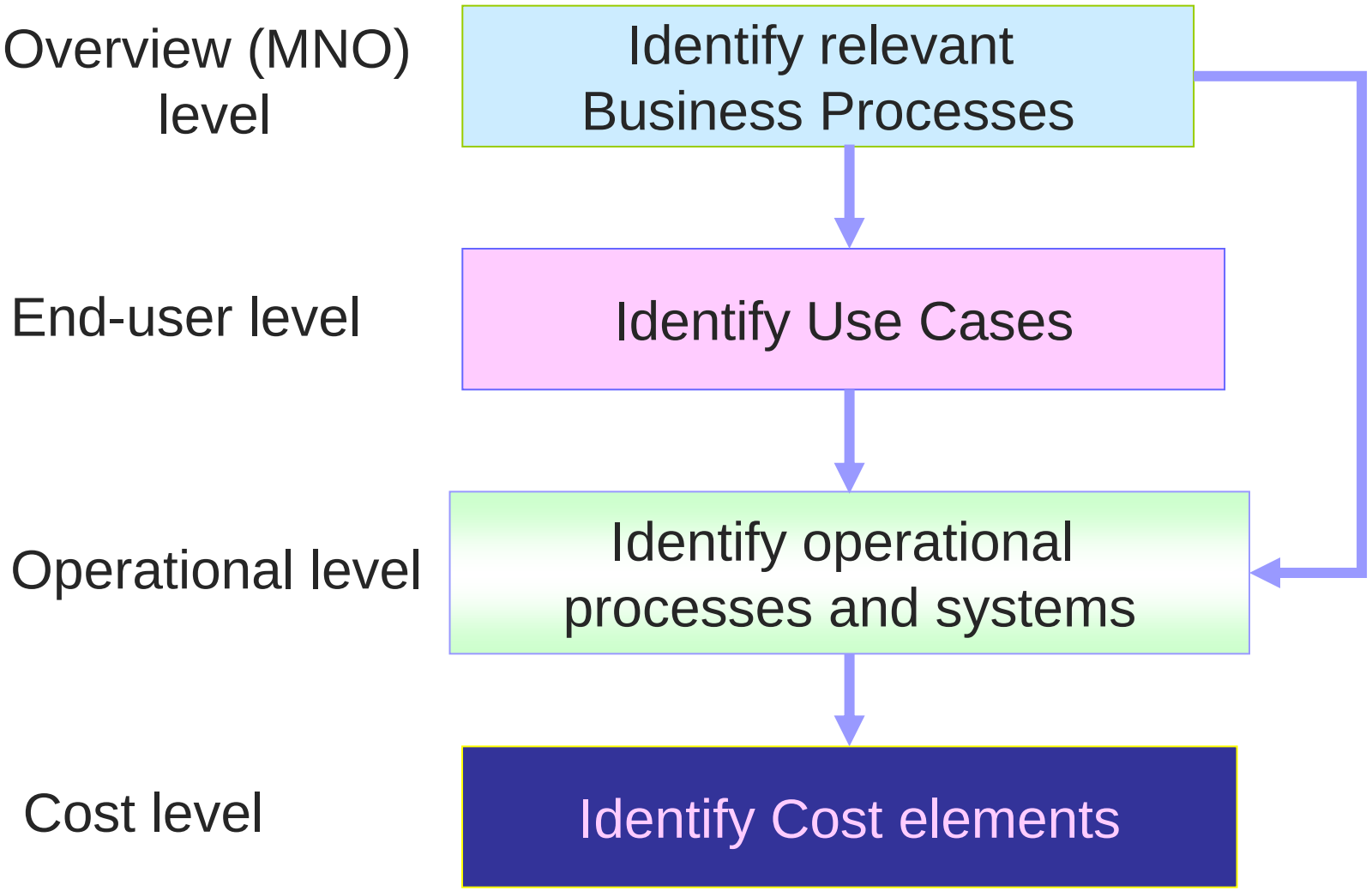
MNO= Mobile Network Operator, FNO= Fixed Network Operator
VLR= Visiting Location Register, NOC =Network Operating Centre, & systems

Use cases define the MNO actions necessary to support the subscriber

Use cases are employed as they provide a realistic assessment of cost elements involved which is also:-

- **Technology Neutral**
- **MNO size neutral**
- **MNO/FNO neutral**
- **End to end across networks, BSS, both operators and any additional systems or processes**

Costing mechanism used in the roaming cost model



The MNO runs on business processes that are defined by the subscriber needs for using the mobile communications network, with its business support services, and all the business operations

The major business processes for the MNO:-

- Acquire assets including real estate for BSTs, network equipment, IT systems, data centres, etc
- Build network
- Rollout network services and value added services – eg mapping, Apps Store, etc
- Operate networks and services
- Acquire subscribers
- Register subscribers
- Activate subscribers
- Provision subscribers
- Retain subscribers
- Billing for domestic and roaming services - plan, build, train, operate, maintain
- Customer care – services and infrastructure – plan, build, train, operate, maintain
- Handle network management, including repair teams - plan, build, train, operate, maintain
- Manage logistics for network elements
- Manage logistics for retail sales channels, especially handset inventory and supplier contracts
- Acquire, equip and manage tied or owned retail outlets
- Marketing, with promotions, handset subsidies, etc
- Sales, with contracts and/or prepaid
- Accounts, with accounts payable and payroll
- International negotiations for roaming agreements
- Regulatory negotiations and policy with spectrum acquisition

Each business process will breakdown into subsidiary or component business processes, defined in aggregated mode through the user experience, often via 'use-cases'

Roaming costs

International roaming involves the following activities for equipment, systems and operations:-

- **Collection/ transport of call data records (CDRs) with costs of retail billing for roaming subscribers; may include specific real-time systems (e.g. for pre-paid customers) such as CAMEL; (NOTE for prepaid - need for a local recharge hub, or some agreement to use local recharge cards)**
- **Interconnection & transit infrastructure costs for international calls & payments to transit carriers;**
- **Payments for call termination for visited MNO, at wholesale prices, with discrepancy resolution;**
- **Associated additional home network and business systems costs;**
- **Costs of negotiation/upkeep of roaming agreements**

Should this technical infrastructure cause higher roaming costs?

- **The core issue is whether IMR calls have a different & higher cost structure than national "offnet" calls i.e. calls terminated on another network nationally**
- **Reasonable to expect increased network & support systems for IMR capacity**
- **The nature of these extra costs is for network and billing systems to cover international call transport, with wholesale invoicing and retail billing**
- **Questionable whether cost differences are large for this type of expansion over that required for a *national increase in traffic minutes. Likely that* any increase is a *fraction not a multiple of current national real costs***
- **Further investigation requires empirical cost accounting analysis with a cost model that is MNO and technology neutral.**

Cost accounting analysis requirements

- Total roaming revenues (for each service - voice, SMS data)?
- Total costs of roaming (for each service - voice, SMS data)?
- Roaming costs breakdown i.e. costs allocation of items included under capex and opex for roaming?
- Cost items included in the accounts, for domestic services, for both capex and opex?
- Roaming traffic volumes ingoing and outgoing totals for voice, data and SMS?

Examples of MNO cost centres for roaming

COST ITEMS – note that roaming costs be either for dedicated items or they may form *a proportion* of the total cost of the item, possibly less than 10%

- **Network elements costs**
- **Network management and its operational costs (OSS, NOCs, etc)**
- **Network attachments for roaming costs (eg CDR capture and storage with mediation)**
- **Network roll-out , support and maintenance operational costs**
- **IT elements costs in total**
- **Software - eg billing and customer care**
- **IT Hardware**
- **IT Operations including data centres, their support services (eg power) and set up**
- **Other costs – eg special customer service**
- **Roaming Business process – total cost of operations**
- **Cost of accounting for roaming**

Example of overall costs analysis

ITEM - for elements dedicated to roaming, which may be a portion of the total costs	Domestic	Roaming
a) Network elements costs?		
Capex		
Opex		
b) Network management and its operational costs (OSS, NOCs, etc)		
Capex		
Opex		
c) Network attachments for roaming costs (eg CDR capture and storage with mediation)		
Capex		
Opex		
d) Network roll-out , support and maintenance operational costs		
Capex		
Opex		
e) IT elements total		
Total Capex		
Total Opex		
f) Software eg billing and customer care		
Capex		
Opex		
g) IT Hardware		
Capex		
Opex		

Use Cases for roaming

Key business processes for the roaming phases

Handle sign–up when arrive in visited country

Common USE-CASES that define the roaming business processes

1 Place call inside visited country a) to another mobile, offnet or on-net or b) to a fixed line subscriber

2 Place call to home – a) to a mobile or b) fixed termination

3 Receive call from home, a) from a mobile, or b) fixed source

4 Place call while in visited country to a 3rd country a) to a mobile or b) to a fixed termination

For voice, data and SMS

Return to home network and sign -up

Business process for sign – up : Visitor enters foreign country and is registered with local visited MNO (GSM/UMTS procedure)

1. Visited MNO responds to request from handset for assignment to network – either through direct sign-up as preferred carrier or by manual selection of MNO

2. Informs the home network MNO of the subscriber presence in the foreign country by TAP file (Transferred Account Procedure). Requests service information (eg whether or not the mobile is allowed to roam) about the roaming device using the IMSI number. If there is no roaming agreement between the two MNOs, service is denied by the visited MNO.

3. If verified by the home network, enters dialogue with home MNO- A) For Pre-paid - check credit available and the appropriate accounting process at roaming rate on visited MNO. Home network has CAMEL module to monitor and control calls made by its roaming subscribers
OR B) For Post-paid – check valid contract details for roaming and roaming allowed.

4. Visited MNO makes entry in customer database to set up new visiting subscriber on visited network following handset request *. At same time, the home network updates subscriber file to indicate now on the visited network so that any information sent to that device rerouted.

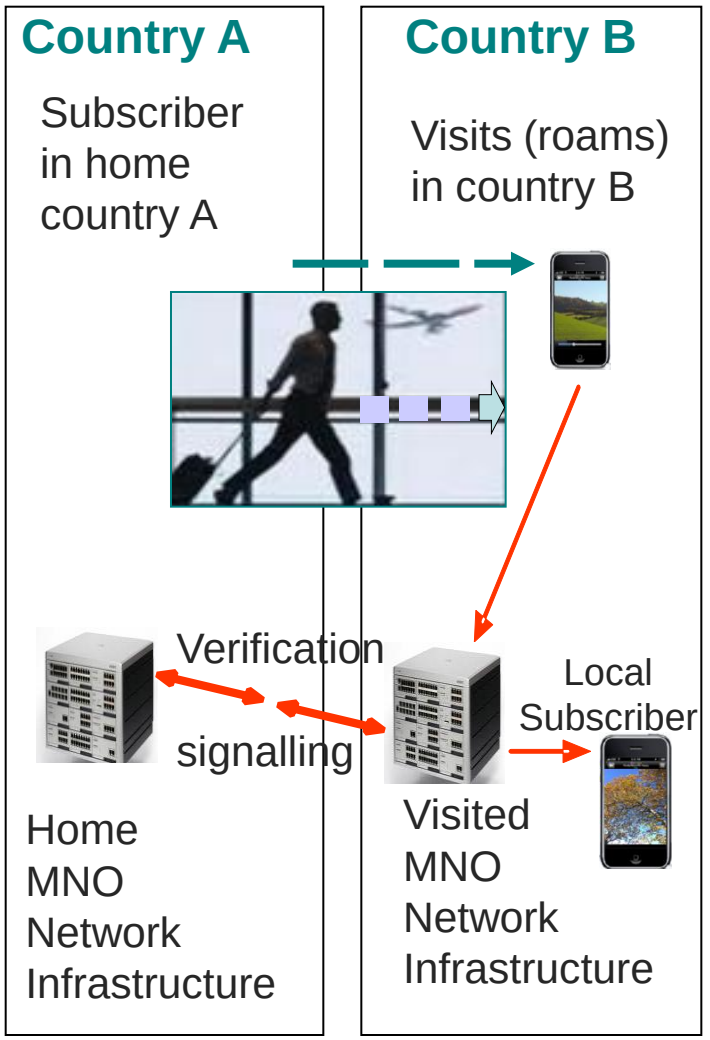
5. OTA activation of new visiting subscriber

6. Send SMS message to subscriber as welcome, showing roaming charge information for voice, data & SMS or confirming all is same as at home (option)

* In some mobile networks, anti-fraud measures are also taken, to transfer unrated CDRs back to the home network much faster than normal, using a hub between MNOs to exchange CDRs and so detect fraud patterns. The hub is termed a “Near Real-time Roaming data exchange” (NRTRDE) following GSMA guidelines, and is supported via shared costs.

For analysis of the International Mobile Roaming service cost structures –

Use Case 1: Roaming mobile call made within visited country

Call type	Cost elements	Use Case Illustration
A traveller from Country A goes to Country B and makes a call to a subscriber in country B Roaming mobile call made within visited country to local subscriber	•Mobile origination in country B •[National transit in country B] •Mobile termination in country B •Roaming specific costs – (technical & operational) eg authentication and authorisation with home MNO •Retail specific costs (technical & operational)	

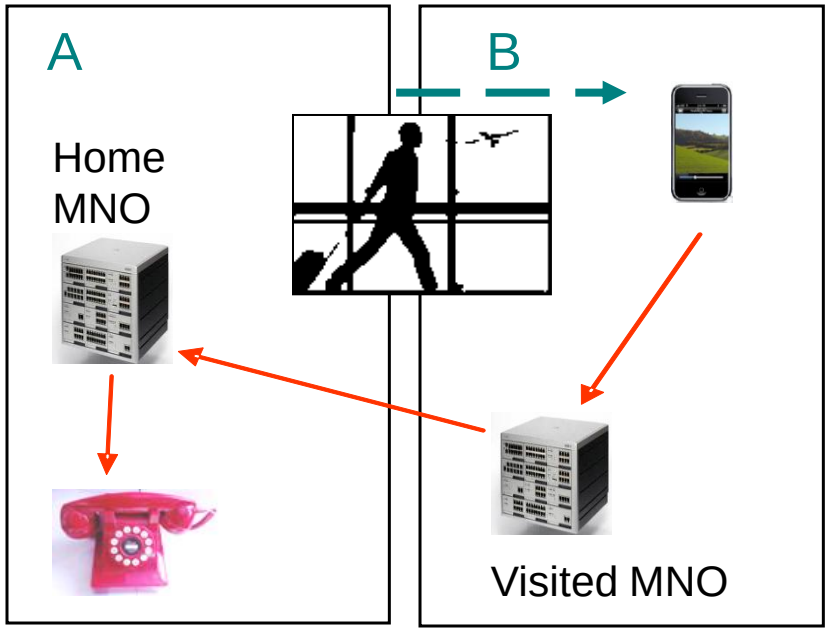
Use Case 2: Call from visited country back to home country

A traveller from country A

goes to country B and

makes a call back home

to a subscriber in country B.



Call type

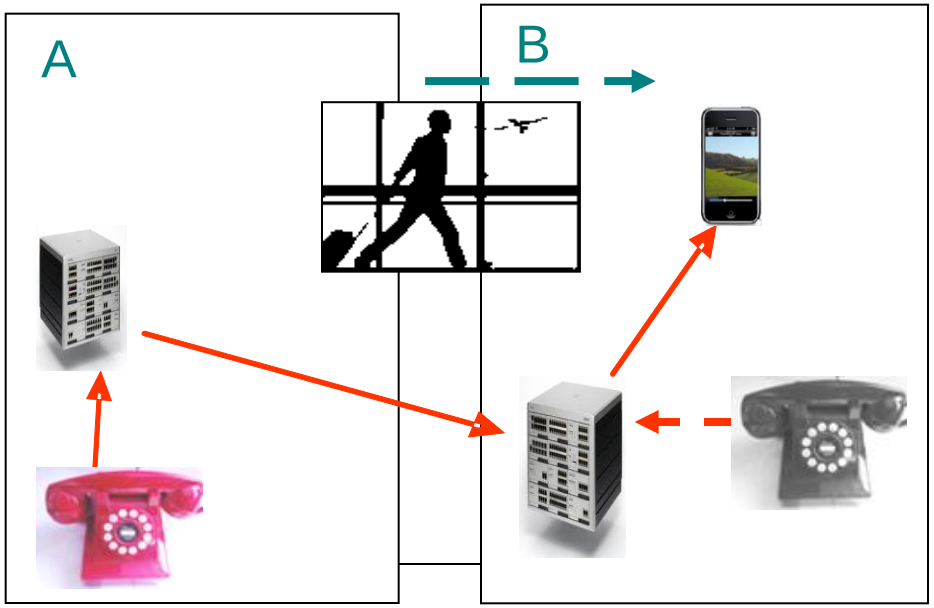
International call back to home country from visited country

Cost elements

- Mobile origination in country B
- International transit
- Mobile or fixed termination in country A
- Roaming specific costs (technical & operational)
- Retail specific costs (technical & operational)

Use Case 3: Receiving a call in a visited country (from home or visited country)

A traveller from country A goes to country B and receives a call - from *either* of the countries A or B – so may be a local or international call



Call type

Incoming call while roaming that originates from home country, or, from inside the visited country, and may come from a mobile or a fixed line phone

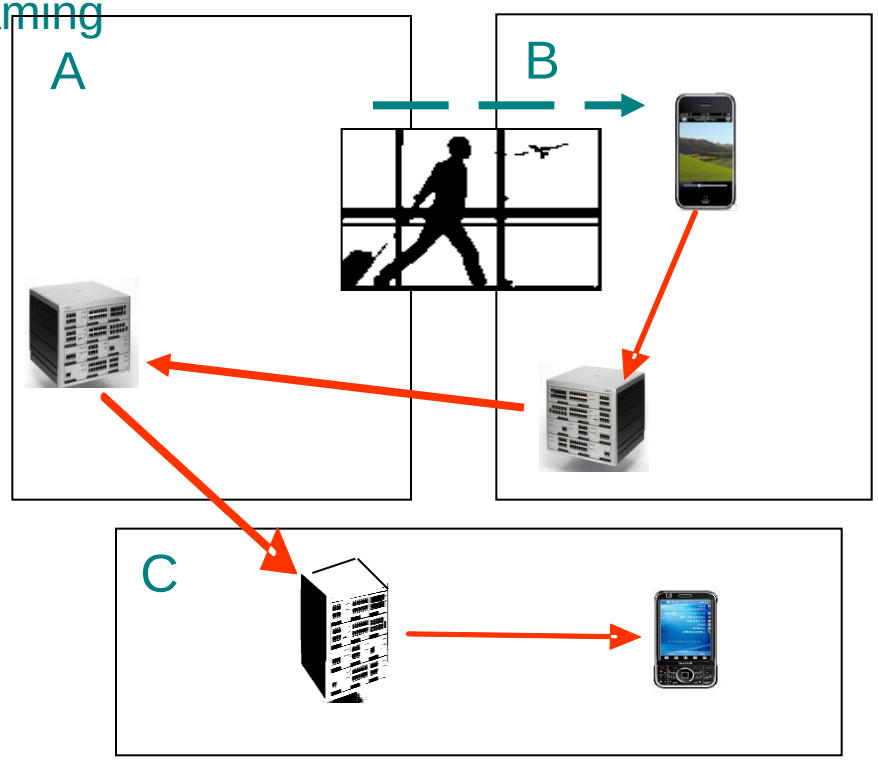
Cost elements

- Mobile termination in country B
- Possible International transit
- Roaming specific costs (technical & operational)
- Retail specific costs (technical & operational)

Use Case 4: Call to a third country while roaming

A Traveller from country A goes to country B and makes a call to a subscriber in country C.

Note that country C may or may not be in a region where international roaming prices are regulated.



Call type

Call from inside a visited country to a third country

Cost elements

- Mobile origination in country B
- International transit
- Mobile origination in country A
- International transit
- Mobile or fixed termination in country C
- Roaming specific costs (technical & operational)
- Retail specific costs (technical & operational)

Information Requirements for the Cost model: obtain the underlying costs of roaming

- To make comparisons- gather BOTH **domestic retail** rates and **roaming retail** rates for visited countries - for voice, SMS & mobile data services

- Gather data for both **prepaid** and **postpaid**

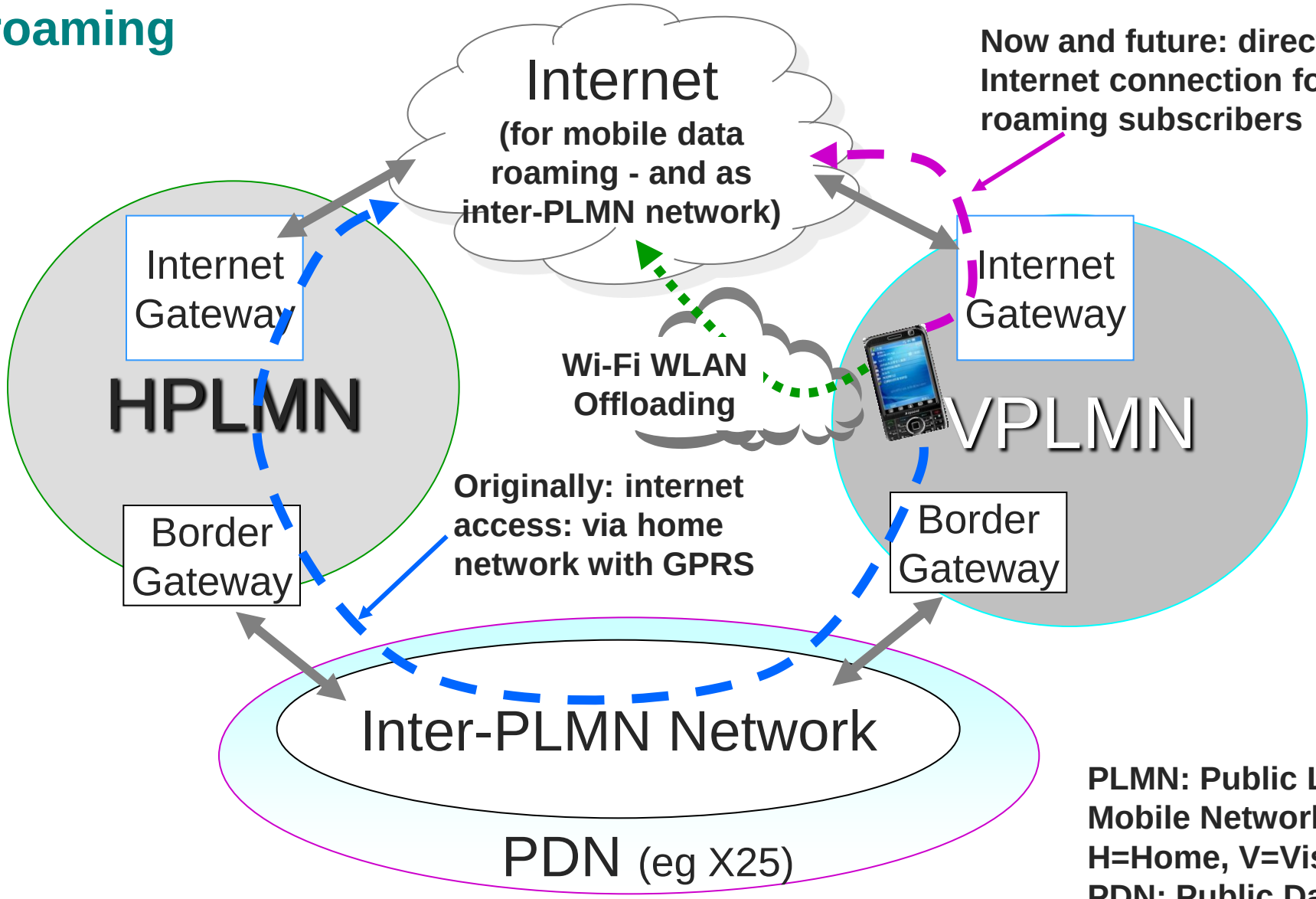
- Requires both **domestic wholesale** rates and **roaming wholesale** rates for voice, SMS and mobile data services

- To see how roaming traffic levels are changing - traffic volumes, for domestic and roaming, for voice, SMS and mobile data services with history (eg over 2 years by quarter) so can compare.

Examples of cost elements involved in the Use Cases for mobile Internet - dependent on the technology

USE CASE	**2G GPRS/EDGE Example**	**3G UMTS Example**	**2G GPRS example of interconnect with 3G IP streaming**
1B : **Send** while roaming: log on to Internet, access email server and send email or data to local subscriber in visited country or elsewhere, or browse web (GSM procedure) or if 3G+, download video or audio or stream video	VLR check: Home network advised, authenticates and authorises; Send data to home MNO for Internet access. 2G RAN and GGSN/ SGSN network interconnect. CAMEL for pre-paid data over GPRS networks and for connecting to visited Internet gateway	Data transfer either with or without Internet gateway. VLR check; Home MNO advised, authenticates and authorises. For connection to 2G network: RAN and GGSN/ SGSN (& CAMEL signalling for prepaid) for network interconnect. Send data to home MNO for Internet access (or 3G + perhaps data transfer via visited MNO Internet gateway)	GPRS tunnelling protocol between MNOs with CAMEL system for 2G pre-paid checking. Possible direct connection to visited MNO's Internet gateway
2B: **Receive** email and data from home, a) from a mobile or b) any internet connected source: log on to Internet and connect to mail server or other dat sources	VLR check Home network advised, authenticates and authorises 2G RAN and GGSN/ SGSN network interconnect: CAMEL for pre-paid for browsing for GPRS data networks	Data transfer either with or without Internet gateway, with VLR check; Home network advised, authenticates and authorises. For 2G, RAN and GGSN/ SGSN network interconnect, CAMEL for pre-paid for browsing for GPRS data	GPRS tunnelling protocol between MNOs with CAMEL system for 2G pre-paid checking. Possible direct connection to visited MNO's Internet gateway

Alternative routes for mobile Internet access while roaming



Source: ETSI (TS 101 393 and others)

PLMN: Public Land Mobile Network; H=Home, V=Visited
PDN: Public Data Network

Gathering the information for the cost model:

Surveying MNOs with a questionnaire to gather the costing information on roaming

The Questionnaire's principles

Analyse the cost basis for IMR charges, using the MNO business model:-

- Examine using a bottom-up view of assets employed for roaming compared to domestic operations:-
  - Network assets involved in roaming process
  - CDR management
  - Business support systems (billing and customer care assets)
  - Any other relevant costs

Analyse whether this view shows that the cost of IMR is:-

- Inflated
- May not justify a wide variance in surcharges by operator and by country

Building the MNO Cost base: Capex & Opex

- Objective of questions is to obtain a clear idea of cost allocation across network elements and other cost items across domestic and roaming services

- Have to differentiate between:-

    - Postpaid and prepaid
    - Voice, SMS and data
    - Networking, BSS and other cost centres

For understanding roaming wholesale prices (voice, data, SMS) key cost parameters are required:-

- Inter-operator tariffs (IOTs) charged by each MNO to foreign correspondent MNOs for terminating roaming calls
- IOTs paid out to correspondent MNOs for domestic subscribers when roaming
- Conditions which may result in differentials (volume discounts, time of day, etc.)
- Domestic call termination rates, with other domestic MNOs and with fixed line operators, in order to compare tariffs with roaming
- Roaming specific costs (billing, signalling, customer care)
- Transit costs
- Cost difference between prepaid and postpaid, domestic and roaming.

Questions for pricing of roaming retail services

- Prepaid and postpaid roaming rates for all countries retail and wholesale, voice, data, SMS? - Use spreadsheets for called and calling country
- Factors used in setting retail prices?
- Time series for prepaid and postpaid retail prices?

Example of spreadsheet

VOICE, Outgoing calls - charges

PREPAID SUBSCRIBER - Retail rates in the Region for voice roaming services: As of (date) in local currency and per minute including any taxes (please indicate if there is a set up charge e.g. first minute is more expensive than subsequent minutes). Please provide peak rate prices and indicate whether there are off-peak prices. Please indicate if there are taxes additional to the normal domestic tax on mobile calls.

COUNTRY	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	0														
B		0													
C			0												
D				0											
E					0										
F						0									
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H								0							
I									0						
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K											0				
L												0			
M													0		
N														0	
O															0

The Questionnaire survey process

- Select most suitable 4 or 5 MNOs for first piloting the data gathering exercise – ie, the most likely to respond, where feedback will be rapid and complete (ie good relationship with NRA and well organised internally, with comprehensive accounting)
- Pilot test the questionnaire and spreadsheets with the selected MNOs
- Analyse pilot survey returns
- Use lessons learnt from feedback to improve the questionnaire before proceeding to information gathering from all relevant MNOs across the visited MNOs
- Proceed to full survey of all relevant MNOs

Pilot Questionnaire: Issue for Comments

- PART 1A Pricing of Wholesale services - for voice, data and SMS
- PART 1B Pricing of Retail services – for voice, data and SMS
- PART 1C Accounting analysis
- PART 1D MNO Costs base – Elements of Capex and Opex
- PART 2: Questions for regulatory bodies to consider and review powers and jurisdiction before questionnaire survey

Mobile markets and policies:

Policies for ROAMING

Thank you

Mobile markets and policies:

Policies for MVNOs

Simon Forge SCF Associates Ltd May 2016

Agenda

1. The MVNO business model - its strategic dependencies and risks.
2. The MVNO variations in operating facilities and technical capabilities including network management tasks and their implications.
3. Impacts of MVNOs on the competitive landscape – why many countries are turning increasingly to the MVNO model. Entry of MNOs into the MVNO market with sub-brands
4. What is the market future for MVNOs? - Evolving new markets for MVNOs – in media and more
5. How do MVNOs impact the use of spectrum?
6. Regulatory implications of MVNOs

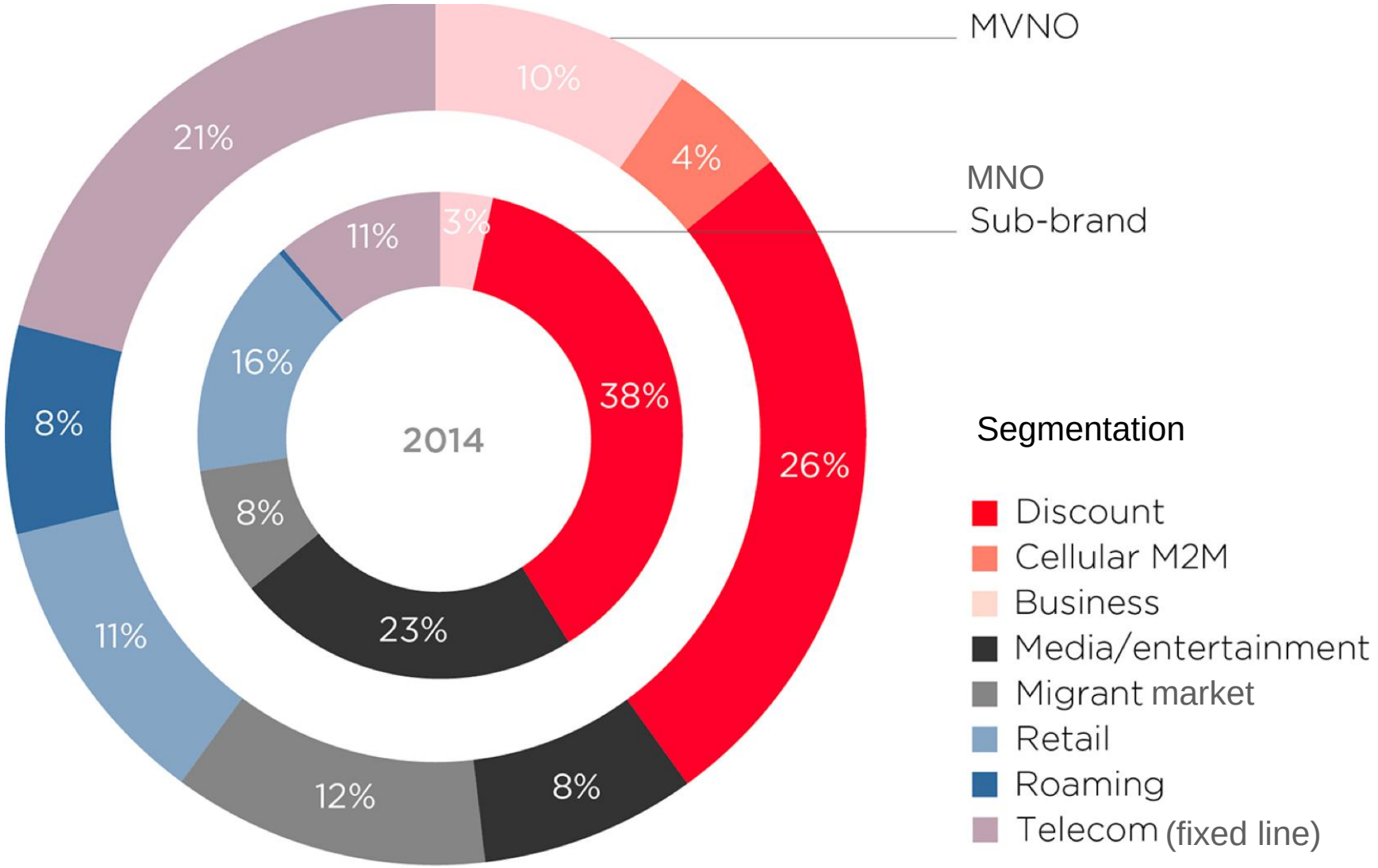
The MVNO business model - strategic dependencies and risks.

- Mobile networks were originally designated as an operator owned infrastructure
- However services and ownership follow a ***layered architecture***, so separation is possible.
- With international standards for protocol layers, all end-users may intercommunicate
- Enables any other entity to use that MNO infrastructure to connect its own customer base
- Thus 'virtual operators' may share MNO infrastructure, increasing its usage while providing competition for the network infrastructure owner at a service level.
- MNOs gain 'guaranteed' revenue stream (as long maintain 'reasonable' wholesale pricing).

- Currently 72 countries, around a third of countries worldwide, have MVNOs present so there are some 992 operating today
- MVNOs most often flourish, with some exceptions, in more saturated mobile markets
- Average mobile connections per head among the 72 countries that host MVNOs is 128 % in 2014, while the global average is 97% penetration[1]
- One of the first commercially successful MVNOs was Virgin Mobile UK, launched in the United Kingdom in 1999 which today has over 4 million customers in the UK.

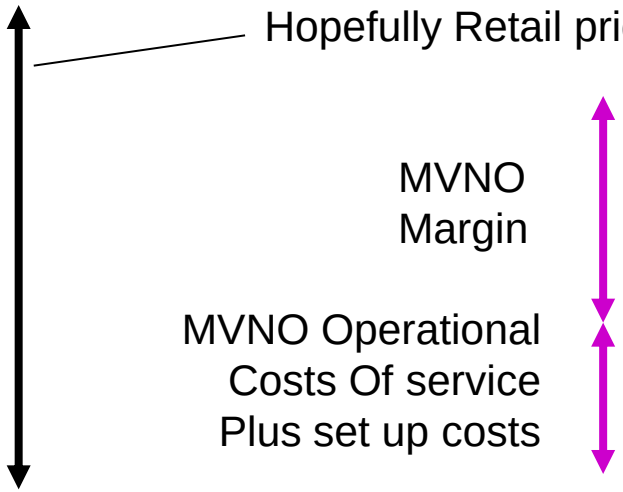
[1] GSMA (2014) The global MVNO Landscape

The MVNO in context
- almost one thousand MVNOs in operation worldwide in 2014

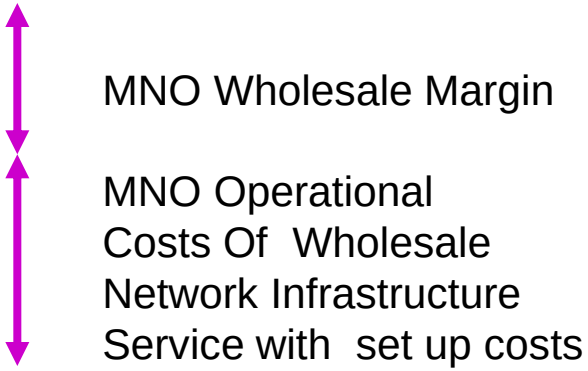


Source: The global MVNO footprint: a changing environment, GSMA , Author Calum Dewar , 20 Feb 2015

The MVNO business model – the price level imperative



MVNO Retail pricing must be set fittingly to enable price competition with sustainable survival



Host: Wholesale network capacity:-
- Main MVNO cost, set with MNO
- Must be set low enough to enable price competition at a retail level

The MVNO business model: strategic dependencies and risks

•Depend for network capacity on MNO to operate at all

•Depend for profits on long term wholesale agreements on a slice of network capacity - so must pay whether used or not

•OR only a roaming agreement with MNO – so pay as use – less risk but higher price

•Depend on MNO for own customer QoS issues - eg MTBF/ MTTR to fix

•Should have capability to offer own SIM card and possibly a retail network with handset sales and support at point of sale – OR totally online and no premises (although supermarket chains see shop presence and familiar brand as a key USP)

•May use the host MNO's BSS and OSS – billing systems, call centres

•Usually has own switch – but can hire MNO capacity or 3rd party

•May depend on MNO for IMR, specifically for its international wholesale agreements & VLR

The MVNO business model: strategic dependencies and risks

• Capex much lower than MNO – so less risk, as less borrowing required (- but higher capex and opex than for a simpler SIM card reseller for an MNO)

• 30% gross margin likely - may not be enough for viable voice-only business

Thus, to get and maintain sustainable cashflows, MVNO may need :-

•To differentiate strongly – with customer care that is better by far, including billing practices, roaming deals etc

• Service simplicity- also for differentiation

• Increased revenue streams - eg inbound calling as well as outbound calling – ie mobile termination revenues shared with MNO, including IMR

• Significant volume of value added (data) services.

2 MVNO variations in operating facilities and technical capabilities (including network management tasks and their implications)

Many variations in the MVNO model in operating facilities and technical capabilities:-

• **MNO may offer far more than a network** – and will charge for that, with Operational Support Systems (OSS) for network management and operations bundled with network capacity

• Next step - offer business support systems (BSS) - 2 key applications may be offered – billing and customer care

•So the MVNO will pay the MNO for its computer data centres and support staff, including electronic billing, bank interfaces for direct debit and/or printing plants for paper bills & mailing

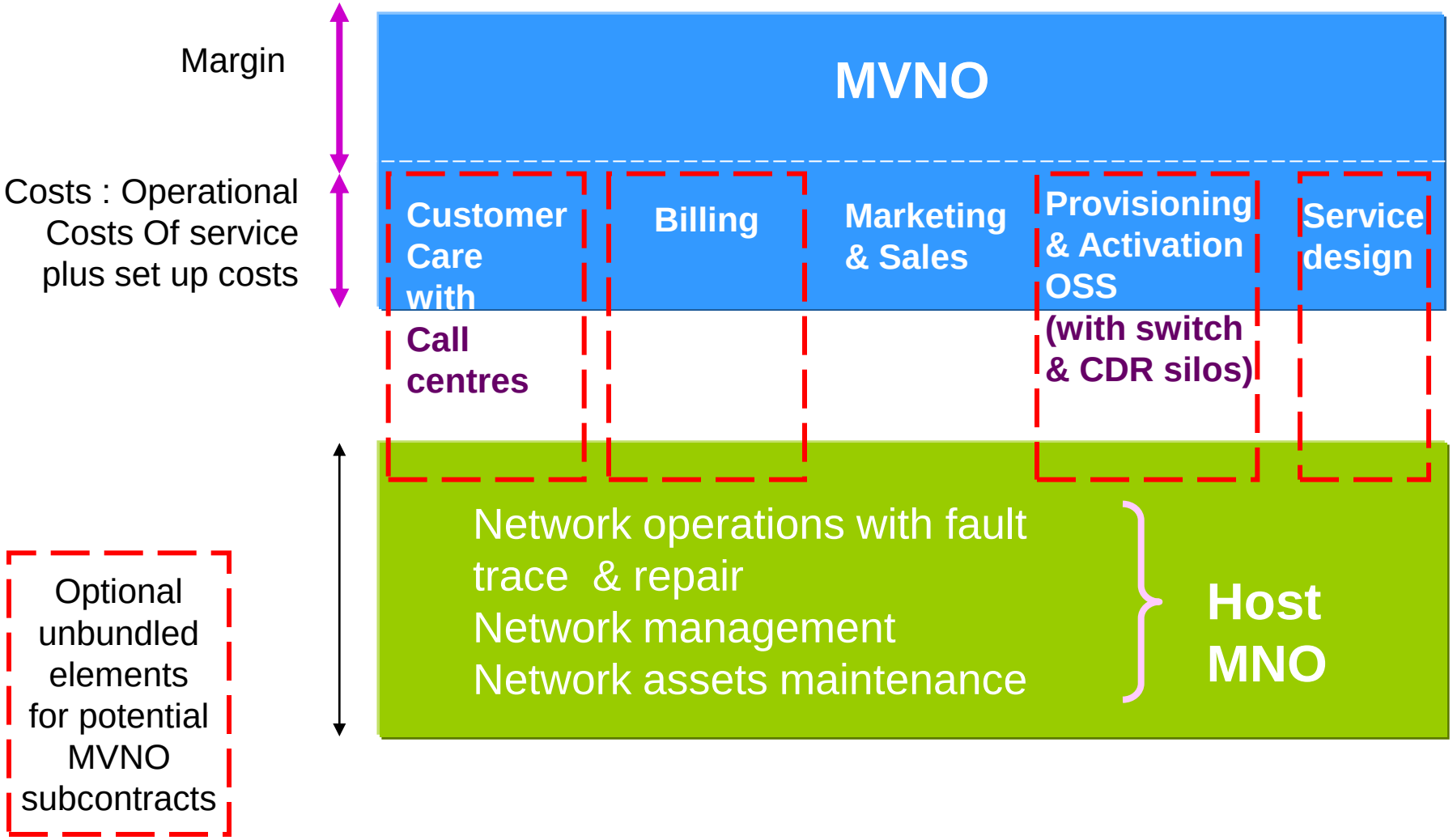
•Typically MVNO business models depend on highly effective marketing as the offering is a resale of MNO capacity in some form against the original MNO service.

•That implies targetted marketing, targetted by price for discount retail sales, or by a special feature - eg *3G SIMcard embedded in a device* - works on *certain MNOs*' networks only – such as Amazon's Kindle –ie *served by a 'hidden' MVNO.*

• Quality of customer service is 2nd pillar for differentiation in the MVNO business model.

• Specialist system integrators for MVNOs now help set up, including bundled MNO agreement!

The symbiotic relationship between services and infrastructure – MVNO and MNO – a moveable feast for the MNO



Variations in MVNO business model – with range of strategic dependencies - and risks.

Asset or Capability	*MVNO*	*MNO*
Branding and promotion	Key asset as differentiator	Key asset
Customer Support Service org with call centres/shops	Key asset as differentiator but may have to rely on host MNO facilities	Owns and operates
SIM Cards	Issues own	Issues own
Network	Varies - rely on MNO mostly - but may have switch, CDR silo, HLR and connection (perhaps Colo)	Owns and operates RAN and Core n/w with switching, VLR and HLR
Spectrum	Rely on MNO	Has exclusive licence
Switch & connection	Varies - May have own	Owns and operates
OSS	Rely on MNO	Owns and operates
BSS	Varies -eg may use MNO billing	Owns and operates
Pricing	Partially dependent on MNO - for wholesale pricing	Independent
Contract conditions	Key asset as differentiator but may depend on MNO for service	Independent

3 Impacts of MVNOs on the competitive landscape – why many countries are turning increasingly to the MVNO model.

•Often MVNOs initiatives are encouraged by regulators as a way of introducing competition to rebalance the market power of incumbent vertical MNOs.

•MVNOs offer alternative service operations without the need for large investment capital, time delay for roll-out or spectrum allocation competition at auction - and also not just for pure mobile communications services

•EG in April 2015, the regulator in Kenya awarded three MVNO licences to seed new Mobile Financial Services (MFS) platforms, with Equity Bank forming FinServe, an MVNO to challenge the dominant MNO with MFS, Safaricom.

•And also MNOs may use MVNOs - claiming SMP balances in merger deals:-

- In March 2016 in UK, the CK Hutchison MNO, Three, proposed acquiring Telefonica's O2
- Tesco, the UK supermarket giant, has operated an MVNO in 50:50 JV with O2 UK since 2003
- This MVNO, ***Tesco Mobile*** has about 4.5 million customers (~ 8% active subscribers)
- Tesco plans taking full control of MVNO if Hutchison succeeds in buying O2 UK
- Then Tesco would hope to forge a long-term network capacity deal with Three
- Hutchison hopes MVNO buyout may convince EC to approve takeover of O2 for £10.25 Bn.

Entry of MNOs into the MVNO market with sub-brands

• There are some 260 MNO sub-brands of MVNO

•These are MNO owned service with specialised features and/or limited pricing as a separated MVNO-type service from the main offering

•May be aimed for a specific market (usually low end consumer) or vertical sector market with its own SIM card (business specials).

4 What is the market future for MVNOs?

• MVNO market value and its CAGR - 2016 expected to see a global MVNO market value of US$ 40.5 Bn[1] growing by 2020 to US$ 73 Bn[2].

• For comparison - global mobile revenue from *all* offerings in total estimated US$ 1239 Bn in 2014, US$1331 Bn 2016, & US$1445 Bn in 2020[3]

•So MVNO segment at around 3% in 2016 and 5% in 2020; CAGR strong ~ 6% since 2012

•**BUT, many market failures** – In last 3 years, MVNOs in mature markets have failed due to the low margins and high competition - especially in USA and Europe - even high-profile brands –eg in USA media/CATV players Time Warner and Comcast; retailer BestBuy

•Naturally MVNOs will also try to enter the mobile broadband data market. But pricing of mobile broadband is fairly clear-cut - differentiation difficult, despite MNO hosts willingly negotiating wholesale data contracts that might enable MVNOs to offer lower prices

• Difficult for the MVNO to offer lower retail prices than the host MNO in long run as MNOs offer major discounts to own hi-end customers for larger volumes. Leaves little for MVNO differentiation, unless additional services added - Internet access, which an ISP could offer

•Many would-be MVNOs may struggle to replicate the unique success of Amazon's content-based pricing (hiding the mobile data fees) for its tablets.

[1] Visiongain MVNO market report, Nov 2011
[2] Grand View Research Inc, Market report, March 2015
[3] Statista, 2015, revenue forecasts 2012 to 2020

Evolving new markets for MVNOs – in media and more

MVNO Role	Description
Discounter	Primary proposition is as a lower-cost service
Quad play	MVNO as part of combined triple or quadruple play of telecommunications package, eg Virgin – includes fixed line broadband for Internet access, fixed line (voice) telephony for PSTN and TV content. A variation is internet services included, such as an ISP may offer, eg Google. In future, more SVOD services likely – for Netflix type offering over fixed line broadband.
Retail	Often supermarket chains – physical presence as USP with device sale.
MFS	Mobile financial services –specialised - often with banking partner.
Roaming	Based on wholesale international voice, SMS and data markets, usually with own pre-paid SIM cards, using roaming agreements with MNOs across multiple markets
Media/ entertainment	Content access for associated media and entertainment players.
Migrant markets	Focus on international voice but in future more Skype like OTT video calls for smartphones – probably with own Internet gateway or wholesale agreement
Business	Targets the business segment with specific products eg voice conferencing
Data only	'Embedded' for devices with own SIM card embedded–eg Amazon Kindle - &/or with dongle – voice can be added – bundled with device - not evident.
M2M	Machine-to-machine services (embedded) SIM-based cellular data services

- Expect more combinations with OTT services using mobile breakout locally.

5 How do MVNOs impact the use of spectrum?

•MVNOs by nature tend to enhance re-use of existing spectrum assets, so limiting demands for extra spectrum use, as re-use existing

•Spectrum comes as a part of the infrastructure on which they are hosted

However their need to serve more subscribers at the same time as the MNO host over the same bandwidth means enhancements and additions to existing spectrum bands may be needed. Various techniques available, eg:-

•Supplementary downlink (SDL) using a dedicated band for higher speed data downloads

•Bonding – using (new) disparate links, eg in upper UHF band at 2GHz & 3Ghz, in concert with original MNO bands in the sub 2GHz band or sub 1GHz band, (700 to 900 MHz) for conventional 2G, 3G & 4G RANs aggregated logically to give wider single band effectively

•Optimised channel assignment - considered useful for LTE and future technologies (ie for small cell/5G).

•More techniques arriving with LTE (eg duplex over single channel cancellation)

6 Regulatory implications of MVNOs

•In some regions such as the EU, entry of MVNOs encouraged by NRAs, to increase competition and reduce prices, while boosting network infrastructure usage.

•MVNO presence identified as contributing to slow but steady ARPU reduction in the region, giving consumers better value for money.

•In reaction, MNO-centred industry groups seem ambivalent and even to oppose MVNOs (despite the reality that MVNOs actually often may be MNOs while MVNOs may also be members). Citing their competitive impacts[1], argument put forward that MVNOs reduce ARPU and thus future network investment.

•However, the causal chain for that link to new investment may be difficult to show conclusively. For instance, MVNOs are linked in such arguments to a slower LTE roll-out in the EU – rather than other factors, such as the MNOs' preferences for maintaining current revenue streams from prior investments in 2G and 3G assets - and customer apathy

•Moreover, the EU mobile industry cites other reasons also for slower LTE roll-out than USA - reductions in IMR margins in the EU, technology immaturity, overall risk, lack of low cost capital, etc.

[1] Ibid, GSMA (2015) The global MVNO Footprint – A changing environment, FEB 2015

NRA and Government Policy for MVNOs

Thus regulators and administrations should consider the entry of MVNOs as a useful and positive sign of healthy competition as they tend to:-

- Temper the SMP impacts of dominant MNO players
- Encourage new entrants who do not have to have the capital for a complete new infrastructure and so not require new spectrum in an era of apparent spectrum famine
- Enable improved efficiencies to made in use of the existing network assets
- Provide strong price competition for the host MNO and for all other MNOs
- Offer new mobile services – and not even those driven by communications - but by eg MFS – mobile financial services – completely different banking , for the unbanked poorest of the nation.

- In the **case of roaming** in the EU, the EP and the EC under the Roaming lll Act of 2011, enabled MVNOs to enter the international **wholesale** market for IMR and thus to purchase capacity and compete with MNOs in the IMR market.

- This is a further step in competition policy for NRAs especially where IMR charges are considered excessive.

Recommendations for NRAs

•Encourage MNOs to enter the wholesale market, at pricing that will support entry of MVNOs

•NRAs should enable MVNO entry, through the issue of licences for MVNO operations

•It may be necessary to include MVNO conditions within MNO licences through mandatory creation of a wholesale offering – the pricing such and offering should enable retail competition

•Remove barriers to MVNO entry - eg in any practice that ties customers to MNOs and excludes their switching to an MVNO.

•Leave MNOs and MVNOs to negotiate supply conditions.

•Without strong evidence of market failure, NRAs should be reluctant to intervene in MVNO operations, pricing and ease of market entry.

•In some regions, competition authorities have raised **concerns about mergers that reduce the number of MNOs** in a national market from 4 to 3

• Generally regulatory concerns are over mergers leading to higher prices at the retail level - Studies of Austria and Ireland point to some 20% higher retail prices than in previous higher competition situations with 4 MNOs

•Moreover higher prices may also be due to much less scope for MVNO deals at the *wholesale level* - having immediate direct affect on retail level competition

•The weakening of MVNO competition may be a deciding factor in raising retail tariffs.

Recommendations for NRAs in absence of sufficient MVNO competition

In this case somewhat more active measures may be needed : the NRA should monitor the market at 6 month intervals to ensure that:-

• Competition is working in terms of sufficient multiple offers and pricing (eg minimum 6 offerings, between independent MNOs and independent MVNOs). In particular in extreme cases further measures could be entertained, for example, checks for:-

•MNOs are respecting their SLAs:

•In the case of non-conformance by MNOs to SLAs, a standard penalty should be paid – eg 10% of MNO annual company revenue to the regulator who will immediately compensate the MVNO and also ensure all SLA penalties are immediately paid to the MVNO.

•In the case of two or more SLA infractions further interventions may be useful:-

• Eg the MNO company board may be immediately replaced, with all executive managers in operations, finance and strategy, accompanied by a 5 year ban on all such barred personnel and board directors from holding managerial or operational positions in the telecommunications sector.

Recommendations for NRAs in absence of sufficient MVNO competition

NRA interventions must be aimed at promoting a more transparent market in mobile telecommunications, and reducing the barriers to switching a mobile operator.

Measures to consider include:-

• Time limits on number portability for switching to a new MNO or MVNO operator (the Australian process can take as little as 4 hours) – thus perhaps 6 - 24 hours

• Consumer awareness campaigns for easy and immediate access to an NRA ombudsman in case of customer complaints, with empowerment of consumer organisations

• Simplified bundles, to aid switching decisions by clearer comparisons

• Monitoring of customer contracts conditions to conform to consumer organisation guidelines; Eg limits on length of contract text to a few A4 pages in 12 point type; clarity of language to a reading age of 14 years for contract conditions, with presentation standards for layout.

• Limits on contract duration to 12 months maximum; also, one offering of monthly renewal

• The creation of a consumer's charter structured with consumer organisations with principles mandated by the regulator that are binding on the MNOs.

•The charter is the basis consumer awareness campaigns, to cover contract conditions, format and length of contract, and number portability

Mobile markets and policies:

Policies for MVNOs

Thank you

Session 3

Mobile markets and policies: Consumer Protection and Spectrum

Bangkok, 3 May 2016

Future trends of Internet regulation: Considerations for Thailand
From Paper #2: Wireless communications and spectrum policy

Centre for European Policy Studies

Session 3: Mobile markets and policies: (part 1)

Policies for consumer protection

and for

Policies Spectrum management

Simon Forge, SCF Associates Ltd

03 MAY 2016

90 min , 2 x 45 mins , 2 x 20 slides

Policies for consumer protection in an era of confusopoly

- when operators can game the market

SCF ASSOCIATES LTD

Agenda

1. Current mobile offerings – the complexity of alternatives.
2. Effects of choice overload on consumer bias for status-quo predisposition and the potential for advantage by telecoms operators
3. Impacts of consumer confusion on overall strength of competition - ie use of overwhelming complexity of markets to induce anti-competitive effects
4. Reduction in switching between mobile operators due to deliberately confusing presentation of pricing information and options.
5. Potential solutions - behavioural economics with optimal defaults
6. Regulatory implications of acknowledging confusing complexity in markets constitutes market failure – the actions to rectify market failure
7. Implications for competition authorities as well as telecommunications NRAs.

1 The sheer volume of information available on mobile offerings and their service plans can be highly confusing for consumers

In the UK there are an estimated 12 million mobile contracts to choose from [1]:

- Too many tariffs with quite different pricing structures
- Tariff comparisons complicated and confusing - unnecessarily so - in many cases

Survey of mobile market highlights enormous range of offerings:-

- Bundles of minutes off-net, minutes on-net, fixed and mobile terminations plus GBytes of data per month, with free voice minutes, free texts
- Penalties for exceeding data or free voice limits with high cost premium rates = "BILL SHOCK" - may be hidden in small print ie essentially undeclared
- Focus on front-end benefits (such as low cost or free during introductory honeymoons) while downplaying long term costs
- Limited time 'special' offers
- Increased rates for mobile roaming nationally off-net, internationally or in some countries (eg Canada) for long distance against an arbitrary local area (*the 'bubble'*)

[1] Ofcom (2013) A Review of Consumer Information Remedies, Research Document, 12 March 2013

Current mobile offerings – a complexity of alternatives

Result is impenetrable tariffs and (deliberately) opaque special offers and contract conditions:-

- ‘Confusopoly’ reigns -ie a group of companies with similar products may intentionally confuse customers instead of competing on price
- Leads to customer lock-in – *literally*, if the phone is locked to the network - and customers do not realise it can be unlocked

Challenge for the majority of consumers is to process, compare and select from millions of options offered:-

- Cannot assess different bundles in terms of payoff between prices & packages of the different options on offer as far too many
- Impossible to understand all the offers - cannot make comparison with existing contract arrangements So cannot choose a service that optimally meets their needs.

Even more confusion with smartphone purchases where applets purchased from 3rd parties through multiple platforms (Apple iTunes, Googleplay etc) – ie multiple contracts (& explosion of ‘*small prints*’):-

- Force further spend to upgrade smartphone operating software to run the applet
- ‘Free’ apps may incur advertising downloads (and airtime charges), phishing, online subscription sign–up via App download - ie without customer realising has signed up.

2 Effects of choice overload on consumer psychology - bias for status-quo = advantage for telecoms operators

•In a world of confusing choice, justification for change towards a new tariff or a new operator becomes much harder.

•This is affected also by a lack of information on two key factors:-

•How easy it is switch – ie what is the process, how much does it cost, how long does it take will there be penalties – eg for contract termination?

•How do the other rival offerings compare?

Investigations by the UK's Competition and Market Authority (CMA) indicate consumers tend to care more about losses than gains.

•They become inert – ie they will not take a decision that changes the situation, for fear of it getting worse[1].

•Fear of making a bad decision by switching outweighs the possibility the consumer might well gain by switching; that makes consumers over-cautious in choice of mobile package.

[1] David Currie, (2014) Homo economicus and Homo sapiens- the CMA experience of behavioural economics, Chairman's speech, CMA, April 2015, New Zealand

The paradox of choice

•The more variety in price and content, the more confusion and discomfort consumers may feel [2]

•Most of the time consumers make decisions that are hopefully "good enough", but not necessarily the best -

•Because humans are constrained by the complexity of the environment they are in and their own cognitive limitations.

•

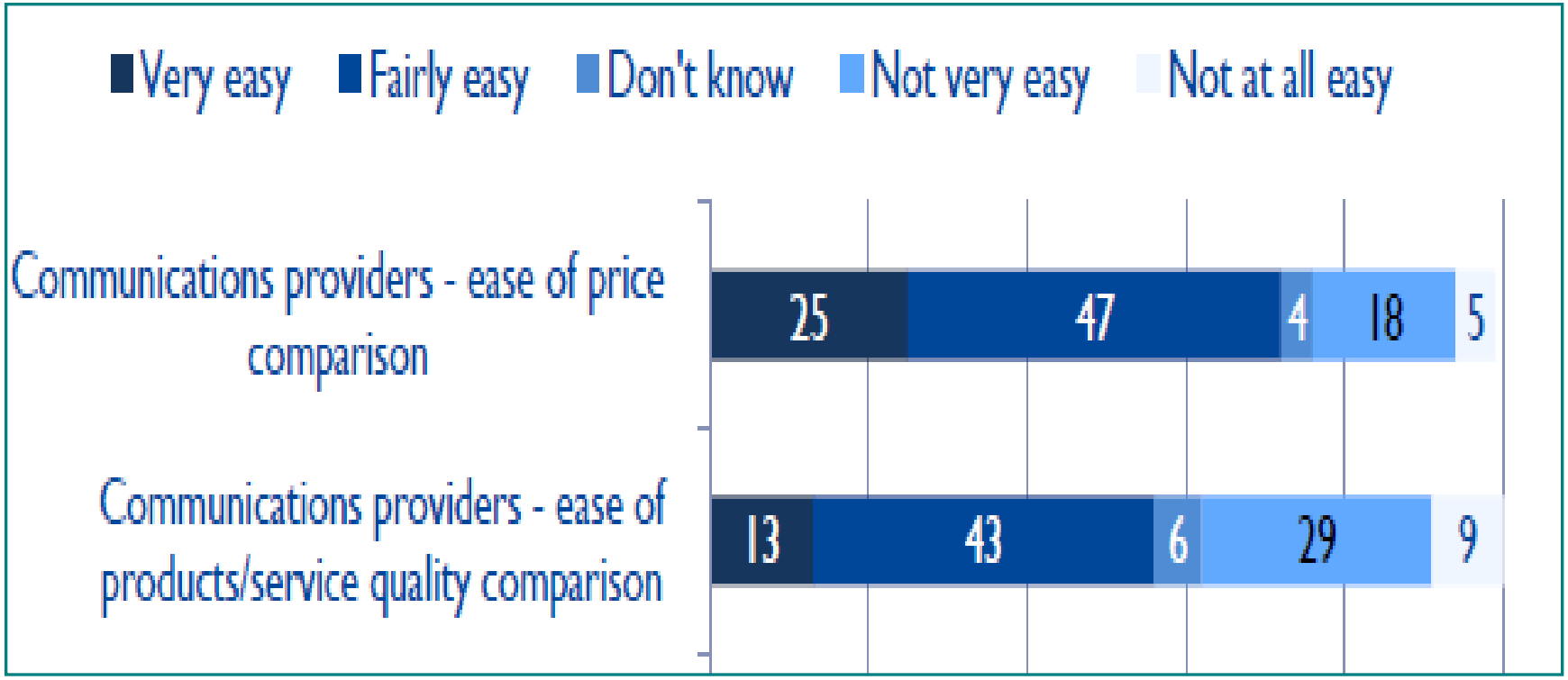
Consumers find too many choices actually demotivating [3] - Excessive choice can paralyse them into not being able to decide what to buy:-

- •Overload of options reduces the confidence in making a choice.
- •Thus, MNOs in some cases use the illusion of better value through the multiplicity of offerings firstly to convince customers to buy
- •THEN to retain customers once signed up by freezing ability to choose another offering. Confusion means that consumers may not be sufficiently aware of alternatives to make a competent choice.

[2] Barry Schwartz (2005) The paradox of choice – why more is less, Harper Perennial, NY, – a psychologist's view on the impacts of choice complexity in society, following Herbert Simon (1950)
[3] Schwartz, B., More is not always better, Harvard Business Review, June 2006

3 Impacts of consumer confusion on overall strength of competition - ie use of overwhelming complexity of markets to induce anti-competitive effects

Ease of comparison of prices and of quality of products/services, in UK



Source: UK Regulators Network (2014)

While 23% do NOT find price comparison easy, 36% find comparison of offerings NOT easy

4 Reduction in switching between MNOs due to deliberately confusing presentation of pricing information and options

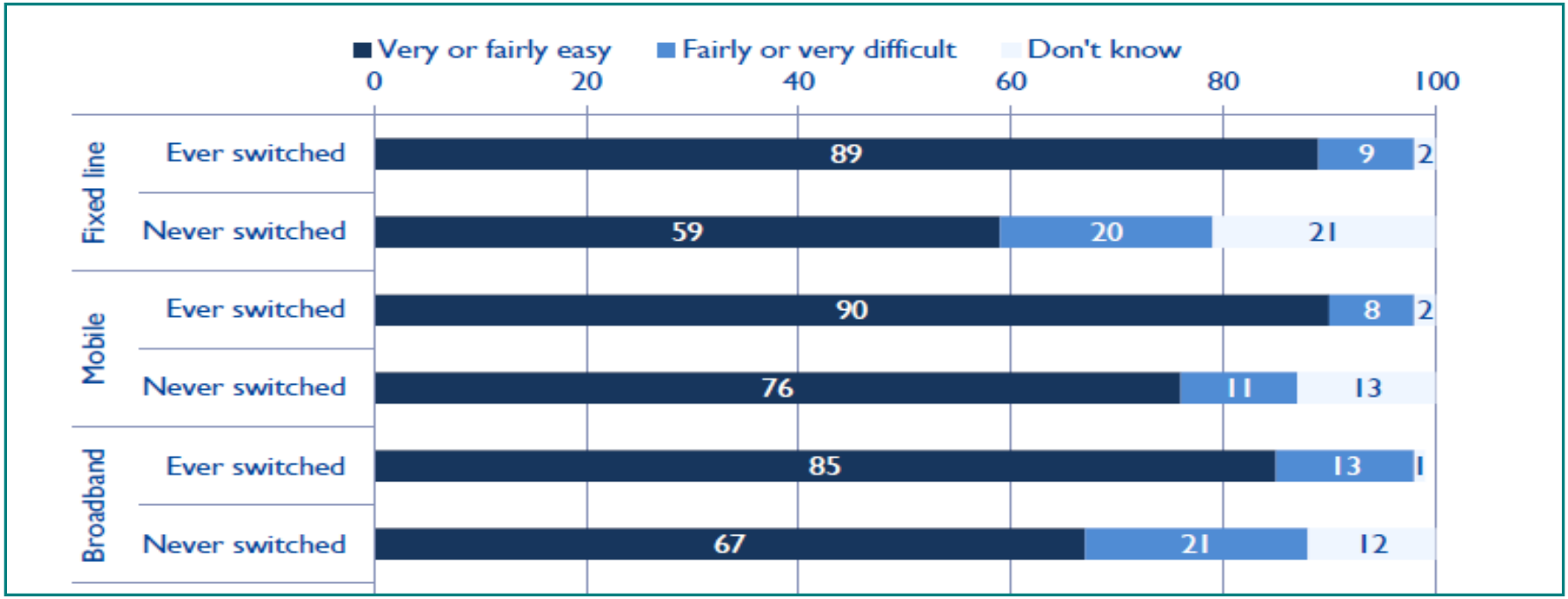
The OECD notes that the ability of consumers to switch suppliers is critical for markets to operate efficiently. It found that deterrents specific to switching were in the form of:-

- Lengthy and cumbersome switching procedures which may make it inconvenient for consumers to switch and can outweigh any potential benefits.
- Early exit charges, imposed by an existing provider, which can reduce the benefits of switching.
- Confusing products and non-transparent pricing of alternatives which can make it difficult and time consuming to compare deals
- Technical incompatibility of equipment which can make it uneconomical for consumers to switch (for example, if they cannot use a blocked mobile phone with their new provider).
- Long-term deals which can lock consumers into lengthy relationships with their providers and increase the risk of them being overcharged. These may increasingly be associated with smartphone deals.

The UK Network of Regulators have examined the ease of switching supplier for those who have never switched and those that have ever switched as shown below in the chart for 3 types of communications.

[1] OECD (2013), OECD Consumer Policy Toolkit Workshop on Communication Services: Summary of Proceedings, OECD Digital Economy Papers, No.221,OECD, http://dx.doi.org/10.1787/5k480t1g546j-en
[1] UK Regulators Network, (2014), Consumer engagement and switching Statement: 17 December 2014

Perceived ease of switching for communications services



Source: UK Regulators Network, Mobile market report (2014)

•For those who have never switched - barrier of difficulty perceived as much higher (by at least 14% for mobile) than for those that have actually switched MNO at some time.

• Fear of the unknown switching cost and effort affects at least one in 6 consumers.

• From research - ease of switching (IN THE UK) may be lower than perceptions shown above.

• However there is evidence that problems are common - around half of those switching in the UK mobile market said they had experienced difficulties

• Problems range from ‘ ‘temporary loss of service’; to ‘provider sending bills for cancelled service’; ‘technical issues’; problems with assuring ‘keeping phone number/email’; arranging start and stop times’, also provider persuasion to stay.

Potential solutions - behavioural economics with optimal defaults

•Faced with complexity of choice people often generally focus on just a subset of the service's characteristics – so easily make bad decisions

•Consumers' decisions usually depend on how choices are framed

•Consumers are often unduly influenced by the information that a major reduction has been made and that the article of services is much cheaper.

•Eg an MNO will state that the bundle on offer is 1/2 price for 3 weeks

•Consumers then take more notice because it has been discounted by 50% than if they were simply told it costs X at the outset.

• People are often very poor at relative probability assessment

• Unsurprising as –
  - Many do not understand the real weighting of percentages
  - Many tend to ***over-estimate*** **the likelihood** of ***small*** **probability** events – eg winning a lottery.

5. Potential solutions -behavioural economics with optimal defaults

Actions for NRAs to balance MNO marketing tactics – to restore fairness:-

1. **From behavioural economics research - NRAs need better remedies than giving *even more* information (hoping for improved competition)**
2. Analyse consequences of consumers having less than perfect information to shift the focus from more information to helping consumers find the ***least*** information that is the most meaningful for decision
3. NRAs must ensure that consumers focus on the **right pieces** of information – which requires care in its form of presentation
4. Information must be simplified and simply presented, so it is straightforward to assimilate– ie real impacts easily perceived as consumers can assess it
5. Such optimally filtered information must be easily accessible - and must also show clearly **how to act** on it.
6. Information remedies that do not meet these criteria will not solve competition problems - much information available to consumers today does not
7. However, selecting and presenting the key facts in the optimal manner **may require mandates from the NRA on MNOs.**

Drivers for switching

Driver	*% consumers switching*
High mobile tariffs	54% to 62%
Poor service’	30
Mobile reception (15%),	15
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Poor experience with 4G service	5
Source: UK Regulators Network (2014)	

The dissuaders – the ‘costs’ of switching

Concern about something failing and **perceptions** that switching will entail significant time and efforts, are commonly viewed as ‘costs’ amongst mobile consumers:-

• So costs are both **financial** - eg early termination charges if switching within contract

• AND **non-financial** (eg time and effort required to find better deal, switch and also get phone unlocked).

• Perception that switching is ‘too time consuming’, is common, due to difficulties in comparing offers, inconvenience relating to signing with new MNO/MVNO and concerns over ***service disruption*** – includes issues such as loss of content, phone number or email address dissuade 5-8%

• 7% of customers cited fears of losing phone number as reason for not switching

Contractual confusion over switching

•Mobile contract can add to complications to switching

•Many consumers lack a full understanding of the fixed terms and tariffs and may feel helpless in view of any price increases experienced under them.

•Trend towards longer fixed-term contracts - at least 2 years now common for smartphone deals - and roll-out of LTE may be extended even more

Confusion takes a number of forms:-

•Common problem : cancellation charges or 'Early Termination Charges' (ETCs), imposed for exiting before the end of fixed-term - now usual

•ETCs may offer a legitimate way for MNOs to recover some fixed costs, but do create barriers for consumers who wish to terminate fixed-term contracts.

•Some 60% of consumers considering switching cited contract terms as a reason for not switching - cancellation charges underlying cause for 40%

Contractual confusion over switching

•Cancellation charges may be present with fixed-term contracts that automatically rollover into a new fixed-term contract

•Means consumers can effectively become ‘locked-in’.

•Without clear contract information, automatically-renewable contracts have a significant negative effect on switching

•Strong fears also over portability and interoperability of services – ie difficulty, delay and whether possible at all to transfer own mobile number and also the handset content from one service/device to another.

•Transfer may take a week or more.

•Problems of interoperability relate to the (in)ability of different services, platforms, handsets and operating systems to work together.

6 Regulatory implications of acknowledging that such confusing complexity in markets constitutes market failure – the actions to rectify market failure

Generally, Regulators should only intervene in markets to :-

- •Promote competition - reduce barriers to switching so MNOs improve service
- •Protect consumers – if possible with greater consumer engagement

There are various forms of **useful intervention for countering confusopoly**:-

- •Consumer awareness campaigns
- • NRA websites - information to help consumers switch
- •NRA campaigns to encourage consumers to engage and make informed decisions. eg to advertise impartial advice on how to compare tariffs, with benefits of switching, then how to switch
- •Set industry performance targets for MNOs on consumer awareness of switching processes (eg as in the UK in 2015 - for switching bank accounts by the Payments Council, or electricity suppliers)

Enforcing Disclosure by MNOs via simplicity and comprehensibility

Level of language in some contracts comparable to Harvard Law Review

•***Disclosure*** is a tool for NRAs to assure MNOs provide customers with the key information to make effective choices.

•Aim is to entirely avoid information overload by intelligent selection, with use of simple, consistent terms and language

•To be effective, NRAs should focus on 'smarter disclosure' - grouping together of just the key pieces of information

•Level of language is critical to simplify the advice in communications & campaigns

One example - **use common divulgence requirements for MNOs**, as **annual statements** to customers, with the key information:-

- Name of the customer's current products signed up for - services, tariffs and accounts
- Conditions attached to the bundle of services and products contracted
- Current tariffs and other one-time or metered charges they are currently being charged
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- The **contract life of the offer** and the time remaining on it
- Details of other similar products available
- Information on a **consumer's ability/right** to cancel with any penalties due

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If strong customer confusion, then NRA may require following to be added in bills (electronic or paper):-

Standardised title "Could you pay less?"

•Information on cheaper tariffs offered by the same operator - and the savings in money terms, if the consumer were to switch, with any 'lock-in' penalties also

•A personal projection of total costs for the next 12 months for the consumer's current tariff plan.

•A signpost to where further tariff information can be found.

•A standardised switching reminder "Remember – it might be worth thinking about switching your tariff or your operator"

Measures to help the consumer

Unbundling of services and products for comparison purposes

Force unbundling of bundled prices - to make price comparison clearer , with whether real ***value for money*** in bundled offer – with real offerings not mythical

MNO Standards of Conduct of business operations

Enforce principles & standards of conduct to ensure MNOs treat consumers fairly :-

• Must **cover all interactions between MNOs and consumers** -marketing tariff and service bundles, customer complaint remedy, halt misleading advertising

• **Clarify information** for customer with professional standards of comprehensibility:-
  - Nothing misleading, all fair to customer
  - Enables easy comparisons with other MNO offerings.
  - Contracts and promotions: **jargon-free language**, easy to understand, in 12 point minimum sans serif text - **no small print in contracts**

•Public statements yearly by MNOs showing actions being taken to treat customers fairly on MNO website.

Measures to help the consumer

Traffic light ratings for simple clarity

•Use **four-tier traffic light ratings** system to rate MNOs - Outstanding (green star), Good (green square), Requires Improvement (orange); Inadequate (red)

•Requires NRA data on QoS from **inspections of MNOs** for clarity of information ; response to complaints and failures; clarity and ease of switching; complexity of offerings/tariffs, etc

• **NRA publishes 6 month report for each MNO** - satisfaction levels for customer service; QoS with dropped call rates, failures, complaints over activation delays, billing and contracts complaints, actual average data rates for mobile broadband; overall customer service level

Accrediting price comparison websites

•NRAs endorse reliable price comparison websites as consumer support tool.

•To achieve accreditation, websites must demonstrate being up-to date, accessible, accurate, transparent and comprehensive.

•NRA must conduct spot-checks on accredited members to ensure they meet accreditation standards and full reviews should take place every 18 months.

•All accredited price comparison websites' access details must be shown prominently on the NRAs and/or government websites.

Understanding consumer behaviour in an online sign–up session

•Much consumer confusion occurs in online web sessions - customers must take decisions for signing up for mobile services

•Major priority for regulators is to understand how consumers behave online for such contracts as online market

•AND how such behaviour might be exploited to their detriment by MNOs.

•If such detriment found, NRA must explore how to remedy without losing any consumer benefits

•So for policy for interventions be successful, they need to be grounded in a deeper understanding of how consumers behave in a particular market context when they face choosing operators, contracts, and their bundled offerings among the many options on display

•NRAs must also perceive how the MNOs behave, within the mobile market's workings especially in modifying levels of competition.

7 Implications for competition authorities as well as telecommunications NRAs

Competition authorities may view the mobile market through its treatment of customers with confusopoly as a case for intervention on the grounds that:-

• Competition is ineffective as customers cannot make rational choices – in practice, competition is absent and the market is not operating efficiently

• Collusion between operators is likely to be present, as differences in pricing and service offerings are not discernable and all MNOs engage collectively in that practice in order to maintain the market balance

• With that, comes lower churn or switching rates and thus costs of churn for the MNOS, as well as the lower marketing spend necessary to retain customers.

• This may be manifested as tacit collusion with no obvious signs yet with an unstated anti-competitive agreement

• Until one of the players wishes to change the market balance, offerings and customer information will remain in overload mode and opaque until one player wishes to change the market balance,

• At that point very simple offerings will be clearly communicated, often using much clearer comparisons with the competition.

7 Implications for competition authorities & communications NRAs

•As consumers are confused they become inert - as they are disengaged

•If there are a significant number of consumers who cannot or will not search or switch for a better deal, then the usual assumptions made by competition authorities about the efficacy of the competitive process may fail.

•That may enhance the market power of MNOs effectively

•Thus numerous initiatives by regulators and governments have been made to encourage consumer search and switching so that the market begins to work, by countering inertia.

•Prompts to consider switching and comparison data - as outlined - is necessary to create a real working market

Implications for competition authorities & NRAs

•At industry level, dominance using confusopoly is possible

•May need to control mergers, or reversal of mergers - or divestitures or splitting.

•So competition authority needs to apply SMP abuse or quasi- monopoly tests to detect market breakdown.

•One such test is the **small but significant and non-transitory increase in the price test** (***SSNIP test or hypothetical monopolist test***)

•Observe whether a player can make a small long term increase in tariffs, apparently not detected by the market – little changes.

•SSNIP test - **see customers' reactions** to small (eg 5-10 %) but non-transitory relative price increase on the services:-

• **Will users switch** away from the MNO offering altogether, for another MNO's offer, **or will they suffer the price increase** – because there is **no effective substitute** that **can be reliably identified** ?

Dangers of behavioural economics use by MNOs exploiting - ‘big data’

•Major implications for competitivity of more sophisticated marketing techniques, eg ‘big data’ using behavioural theory to shape consumer interfacing and offerings:-

• Consumers are **far from being perfect rational market agents**, but they may well be ***predictably irrational in their fears***.

•Even deviations from irrationality predictable – using **consumer profiling, via smart phones,** from web surfing, purchasing record, demographics, income, residence area, etc for **behavioural forecasts** & **specific deviations from norms** of behaviour

•Result may be termed ***an offering for a market of one person*** - at the consumer level - “*an offer just for you*” is promoted

• Based on data mining capabilities of ‘big data’ tools – SAS, Prism, Adobe, hadoop

• **Result** - poor market outcomes that persist are possible, ie consumer benefit is lower than would be without behavioural analysis **used to entice /entrap -**

Critically for competition analysis, increasing use by MNOs of ‘smart marketing’ – which in theory could increase competition – does NOT necessarily improve consumer welfare - may even make worse.

Policies for consumer protection in an era of confusopoly

Thank you

- when operators can game the market

SCF ASSOCIATES LTD

Future trends of Internet regulation: Considerations for Thailand
From Paper #2: Wireless communications and spectrum policy

Centre for European Policy Studies

Session 3: Mobile markets and policies: (part 1)

Policies for consumer protection

and

Policies for Spectrum management

Simon Forge, SCF Associates Ltd

03 MAY 2016

90 min , 2 x 45 mins , 2 x 20 slides

Policies for consumer protection in an era of confusopoly

- when operators can game the market

SCF ASSOCIATES LTD

Agenda

1. Current mobile offerings – the complexity of alternatives.
2. Effects of choice overload on consumer bias for status-quo predisposition and the potential for advantage by telecoms operators
3. Impacts of consumer confusion on overall strength of competition - ie use of overwhelming complexity of markets to induce anti-competitive effects
4. Reduction in switching between mobile operators due to deliberately confusing presentation of pricing information and options.
5. Potential solutions - behavioural economics with optimal defaults
6. Regulatory implications of acknowledging confusing complexity in markets constitutes market failure – the actions to rectify market failure
7. Implications for competition authorities as well as telecommunications NRAs.

1 The sheer volume of information available on mobile offerings and their service plans can be highly confusing for consumers

In the UK there are an estimated 12 million mobile contracts to choose from [1]:

- Too many tariffs with quite different pricing structures
- Tariff comparisons complicated and confusing - unnecessarily so - in many cases

Survey of mobile market highlights enormous range of offerings:-

- Bundles of minutes off-net, minutes on-net, fixed and mobile terminations plus GBytes of data per month, with free voice minutes, free texts
- Penalties for exceeding data or free voice limits with high cost premium rates = "BILL SHOCK" - may be hidden in small print ie essentially undeclared
- Focus on front-end benefits (such as low cost or free during introductory honeymoons) while downplaying long term costs
- Limited time 'special' offers
- Increased rates for mobile roaming nationally off-net, internationally or in some countries (eg Canada) for long distance against an arbitrary local area (*the 'bubble'*)

[1] Ofcom (2013) A Review of Consumer Information Remedies, Research Document, 12 March 2013

Current mobile offerings – a complexity of alternatives

Result is impenetrable tariffs and (deliberately) opaque special offers and contract conditions:-

- ‘Confusopoly’ reigns -ie a group of companies with similar products may intentionally confuse customers instead of competing on price
- Leads to customer lock-in – *literally*, if the phone is locked to the network - and customers do not realise it can be unlocked

Challenge for the majority of consumers is to process, compare and select from millions of options offered:-

- Cannot assess different bundles in terms of payoff between prices & packages of the different options on offer as far too many
- Impossible to understand all the offers - cannot make comparison with existing contract arrangements So cannot choose a service that optimally meets their needs.

Even more confusion with smartphone purchases where applets purchased from 3rd parties through multiple platforms (Apple iTunes, Googleplay etc) – ie multiple contracts (& explosion of ‘*small prints*’):-

- Force further spend to upgrade smartphone operating software to run the applet
- ‘Free’ apps may incur advertising downloads (and airtime charges), phishing, online subscription sign–up via App download - ie without customer realising has signed up.

2 Effects of choice overload on consumer psychology - bias for status-quo = advantage for telecoms operators

•In a world of confusing choice, justification for change towards a new tariff or a new operator becomes much harder.

•This is affected also by a lack of information on two key factors:-

•How easy it is switch – ie what is the process, how much does it cost, how long does it take will there be penalties – eg for contract termination?

•How do the other rival offerings compare?

Investigations by the UK's Competition and Market Authority (CMA) indicate consumers tend to care more about losses than gains.

•They become inert – ie they will not take a decision that changes the situation, for fear of it getting worse[1].

•Fear of making a bad decision by switching outweighs the possibility the consumer might well gain by switching; that makes consumers over-cautious in choice of mobile package.

[1] David Currie, (2014) Homo economicus and Homo sapiens- the CMA experience of behavioural economics, Chairman's speech, CMA, April 2015, New Zealand

The paradox of choice

•The more variety in price and content, the more confusion and discomfort consumers may feel [2]

•Most of the time consumers make decisions that are hopefully "good enough", but not necessarily the best -

•Because humans are constrained by the complexity of the environment they are in and their own cognitive limitations.

•

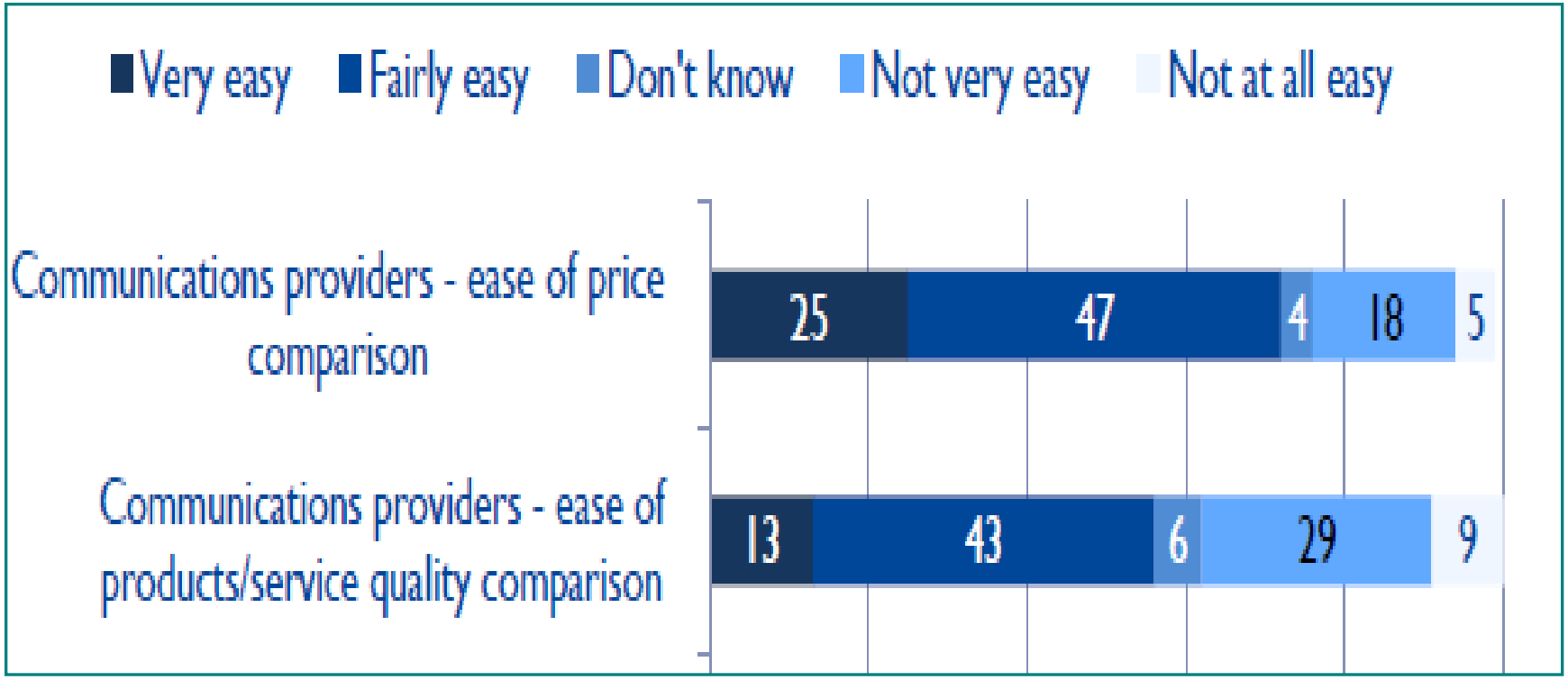
Consumers find too many choices actually demotivating [3] - Excessive choice can paralyse them into not being able to decide what to buy:-

- •Overload of options reduces the confidence in making a choice.
- •Thus, MNOs in some cases use the illusion of better value through the multiplicity of offerings firstly to convince customers to buy
- •THEN to retain customers once signed up by freezing ability to choose another offering. Confusion means that consumers may not be sufficiently aware of alternatives to make a competent choice.

[2] Barry Schwartz (2005) The paradox of choice – why more is less, Harper Perennial, NY, – a psychologist's view on the impacts of choice complexity in society, following Herbert Simon (1950)
[3] Schwartz, B., More is not always better, Harvard Business Review, June 2006

3 Impacts of consumer confusion on overall strength of competition - ie use of overwhelming complexity of markets to induce anti-competitive effects

Ease of comparison of prices and of quality of products/services, in UK



Source: UK Regulators Network (2014)

While 23% do NOT find price comparison easy, 36% find comparison of offerings NOT easy

4 Reduction in switching between MNOs due to deliberately confusing presentation of pricing information and options

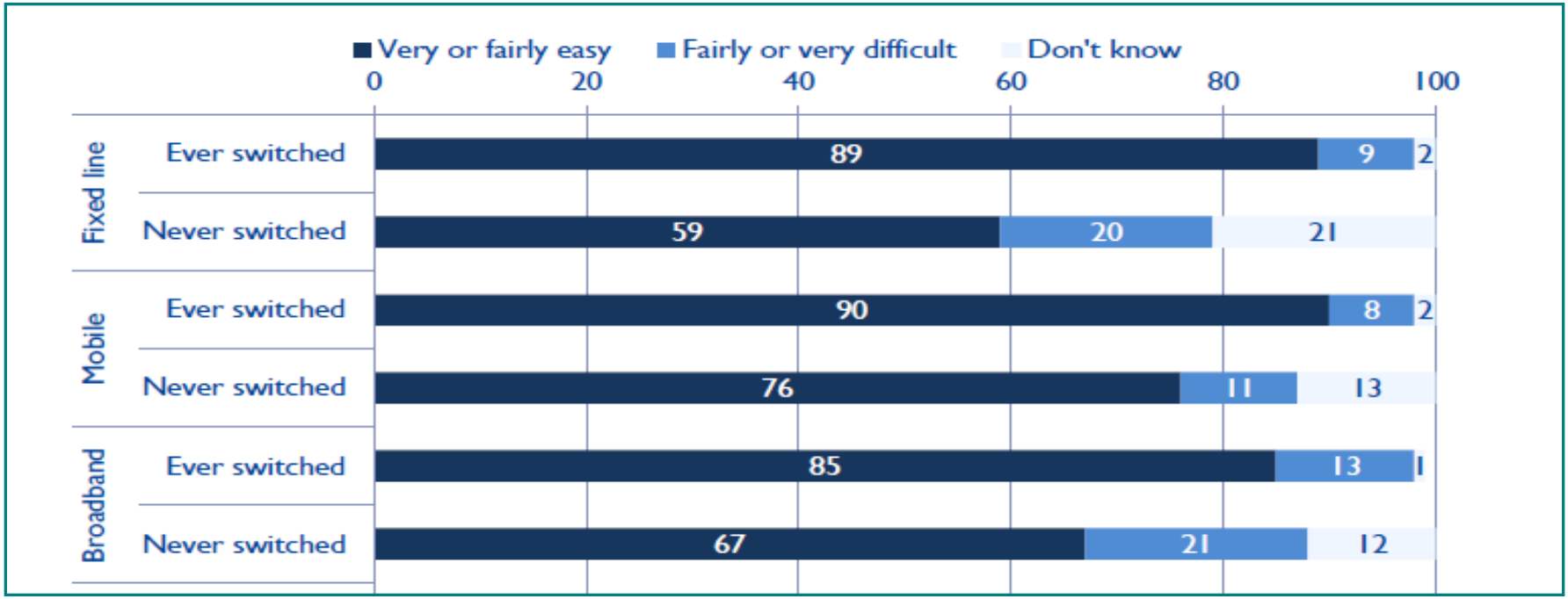
The OECD notes that the ability of consumers to switch suppliers is critical for markets to operate efficiently. It found that deterrents specific to switching were in the form of:-

- Lengthy and cumbersome switching procedures which may make it inconvenient for consumers to switch and can outweigh any potential benefits.
- Early exit charges, imposed by an existing provider, which can reduce the benefits of switching.
- Confusing products and non-transparent pricing of alternatives which can make it difficult and time consuming to compare deals
- Technical incompatibility of equipment which can make it uneconomical for consumers to switch (for example, if they cannot use a blocked mobile phone with their new provider).
- Long-term deals which can lock consumers into lengthy relationships with their providers and increase the risk of them being overcharged. These may increasingly be associated with smartphone deals.

The UK Network of Regulators have examined the ease of switching supplier for those who have never switched and those that have ever switched as shown below in the chart for 3 types of communications.

[1] OECD (2013), OECD Consumer Policy Toolkit Workshop on Communication Services: Summary of Proceedings, OECD Digital Economy Papers, No.221,OECD, http://dx.doi.org/10.1787/5k480t1g546j-en
[1] UK Regulators Network, (2014), Consumer engagement and switching Statement: 17 December 2014

Perceived ease of switching for communications services



Source: UK Regulators Network, Mobile market report (2014)

•For those who have never switched - barrier of difficulty perceived as much higher (by at least 14% for mobile) than for those that have actually switched MNO at some time.

• Fear of the unknown switching cost and effort affects at least one in 6 consumers.

• From research - ease of switching (IN THE UK) may be lower than perceptions shown above.

• However there is evidence that problems are common - around half of those switching in the UK mobile market said they had experienced difficulties

• Problems range from ‘ ‘temporary loss of service’; to ‘provider sending bills for cancelled service’; ‘technical issues’; problems with assuring ‘keeping phone number/email’; arranging start and stop times’, also provider persuasion to stay.

Potential solutions - behavioural economics with optimal defaults

•Faced with complexity of choice people often generally focus on just a subset of the service's characteristics – so easily make bad decisions

•Consumers' decisions usually depend on how choices are framed

•Consumers are often unduly influenced by the information that a major reduction has been made and that the article of services is much cheaper.

•Eg an MNO will state that the bundle on offer is 1/2 price for 3 weeks

•Consumers then take more notice because it has been discounted by 50% than if they were simply told it costs X at the outset.

• People are often very poor at relative probability assessment

• Unsurprising as –
  - Many do not understand the real weighting of percentages
  - Many tend to ***over-estimate*** **the likelihood** of ***small*** **probability** events – eg winning a lottery.

5. Potential solutions -behavioural economics with optimal defaults

Actions for NRAs to balance MNO marketing tactics – to restore fairness:-

1. **From behavioural economics research - NRAs need better remedies than giving *even more* information (hoping for improved competition)**
2. Analyse consequences of consumers having less than perfect information to shift the focus from more information to helping consumers find the ***least*** information that is the most meaningful for decision
3. NRAs must ensure that consumers focus on the **right pieces** of information – which requires care in its form of presentation
4. Information must be simplified and simply presented, so it is straightforward to assimilate– ie real impacts easily perceived as consumers can assess it
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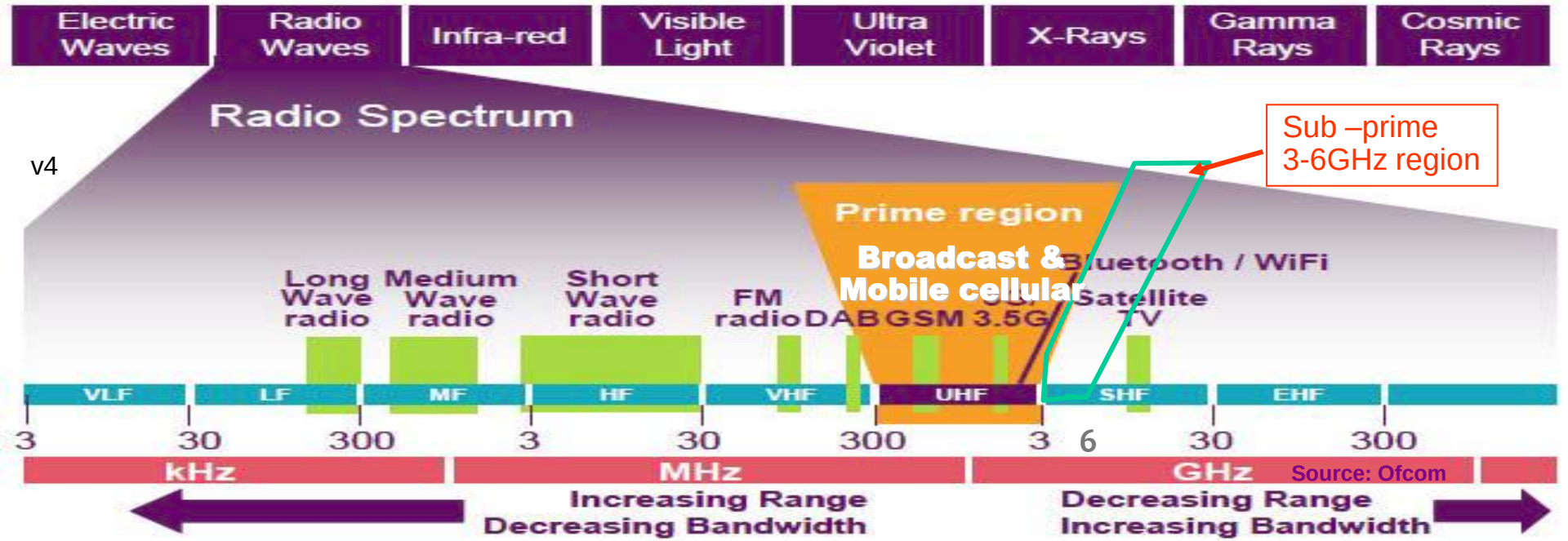
Session 3: Mobile markets and policies: (part 1)

Policies for spectrum management

Source: Valenta, V. et al. (2010) "Survey on Spectrum Utilization in Europe: Measurements, Analyses and Observations" (CROWNCOM-2010) http://hal.archives-ouvertes.fr/docs/00/49/20/21/PDF/paper9220_valenta.pdf

Simon Forge May 2016

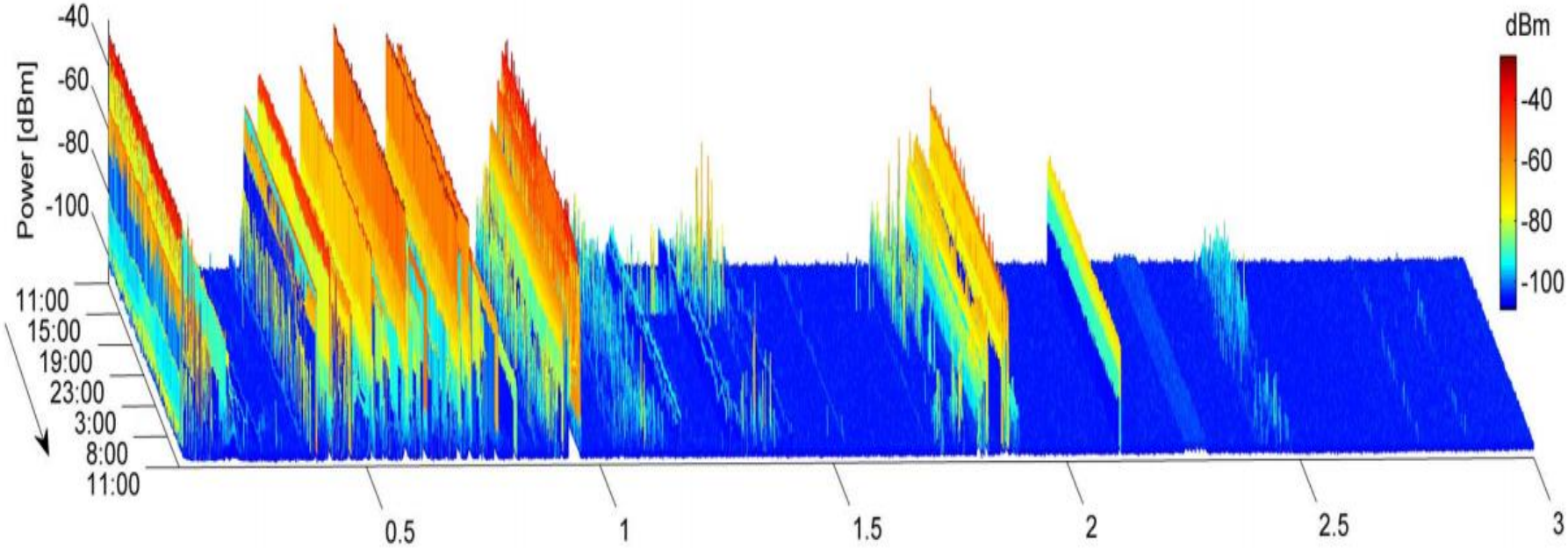


Agenda

- Spectrum occupation today – is it efficient?
- Use of spectrum as an economic stimulant will intensify - more innovations will use radio
- The major actors are changing rapidly - by sector and geography
- Move to more realistic expectations of mobile data for next decade – with spectrum policy impacts
- Spectrum as property tends to reduce - replaced by sharing while forms of sharing will expand
- Changes in regulatory policy will stimulate release
- A summary of trends in regulatory implications for spectrum policy

Today – is spectrum well managed?

Overall, spectrum utilisation is actually quite low (<10% use of assigned) in real time



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But new uses/users cannot easily get authorisation to use radio frequencies …

Just why is this?

- **Low effective spectrum utilisation due to:-**
  - **Exclusive licences for the ‘traditional’ 3 user types**
  - **Overly specific, static allocations**
  - **Inertia - long lags in adaptation to changing demand**
  - **Persistent channel assignments in services with intermittent/irregular channel use**
- **Cause: regulators prioritise interference-free channels for licensees rather than maximum use**
- **Solution: generic allocations with flexible use and least restrictive technical conditions, more general authorisations, more shared access spectrum**

BUT use of spectrum as an economic stimulant will intensify as new innovations emerge in the uses of radio

•Over last decade, spectrum management policy has had to evolve with rising demand for use of radio frequencies

• Spectrum has now become a far more important factor in the economic fabric of every nation –as it can be a catalyst, or a brake on economic development

•Demand has increased more over the last 5 years than last 100 years

WHY?:-

•Enormous returns – revenues from mobile = USD1.24 Trillion in 2014 globally ; broadcast revenues are in addition to that

• Leverage in economic terms of the use of radio based communications of all types is increasing rapidly to drive an economy – eg SME productivity up 6% pa for SMEs* with mobile

• Explosion in applications using spectrum, largely for new forms of communications such as industrial control networks, mobile and nomadic entertainment services channels and constant social networking

• Spectrum's significance as a critical asset accelerating as the dependence on radio communications moves from voice-centred to data and now high speed data

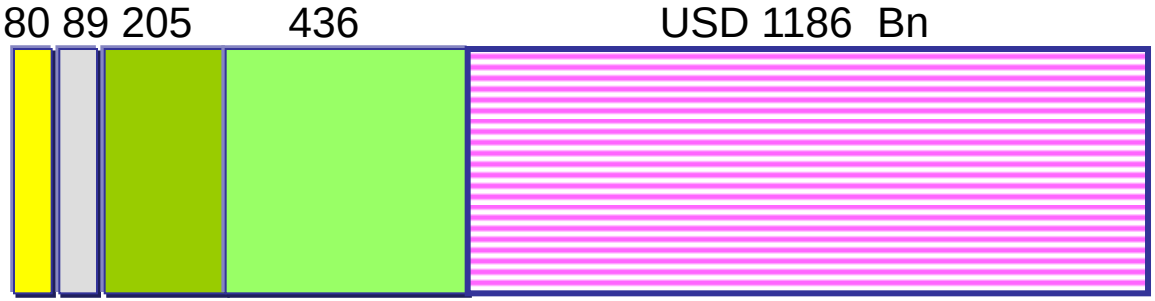
•Since 2005, even before mobile broadband, Waverman** and others have considered that mobile communications appear to expand GDP growth. Some estimate 0.5% - 1% of GDP; Mobile broadband supports internet access - a greater promise of productivity.

* Maliranta & Rouvenin 2006

**Leonard Waverman (2005) studies for Vodafone, etc

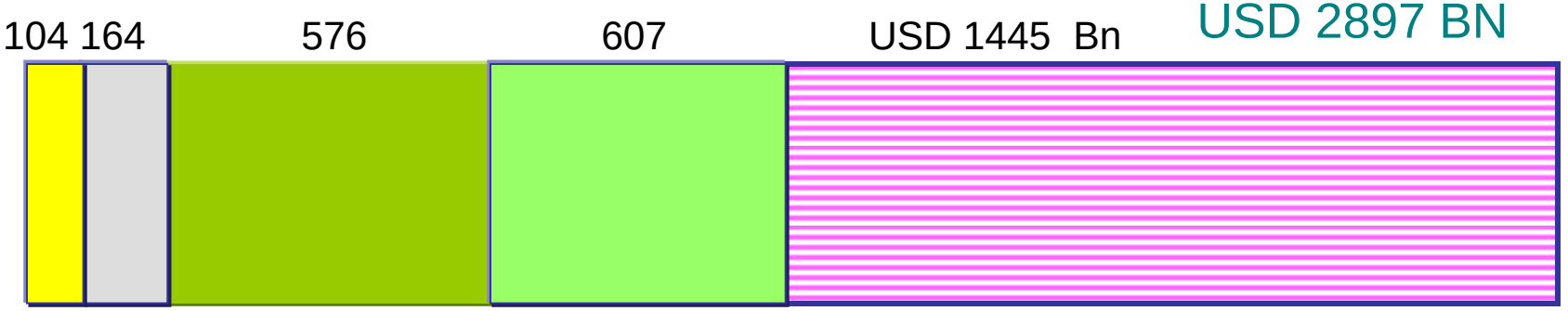
Total estimated revenues for the Mobile industry & its supply chain (goods and services) are growing rapidly

The direct mobile industry value globally, with its supply chain and revenues is considerable, even without its leverage effects on the economy :-



2013 Total
USD 1996 BN

Forecast 2020 Total
USD 2897 BN



Network infrastructure

Devices

Components

MNO revenues from services

Apps, Content, Advertising

Source: GSMA 2015, *The mobile economy in 2014*

BUT NOW - who decides is changing:

•What they will decide on is rapidly evolving

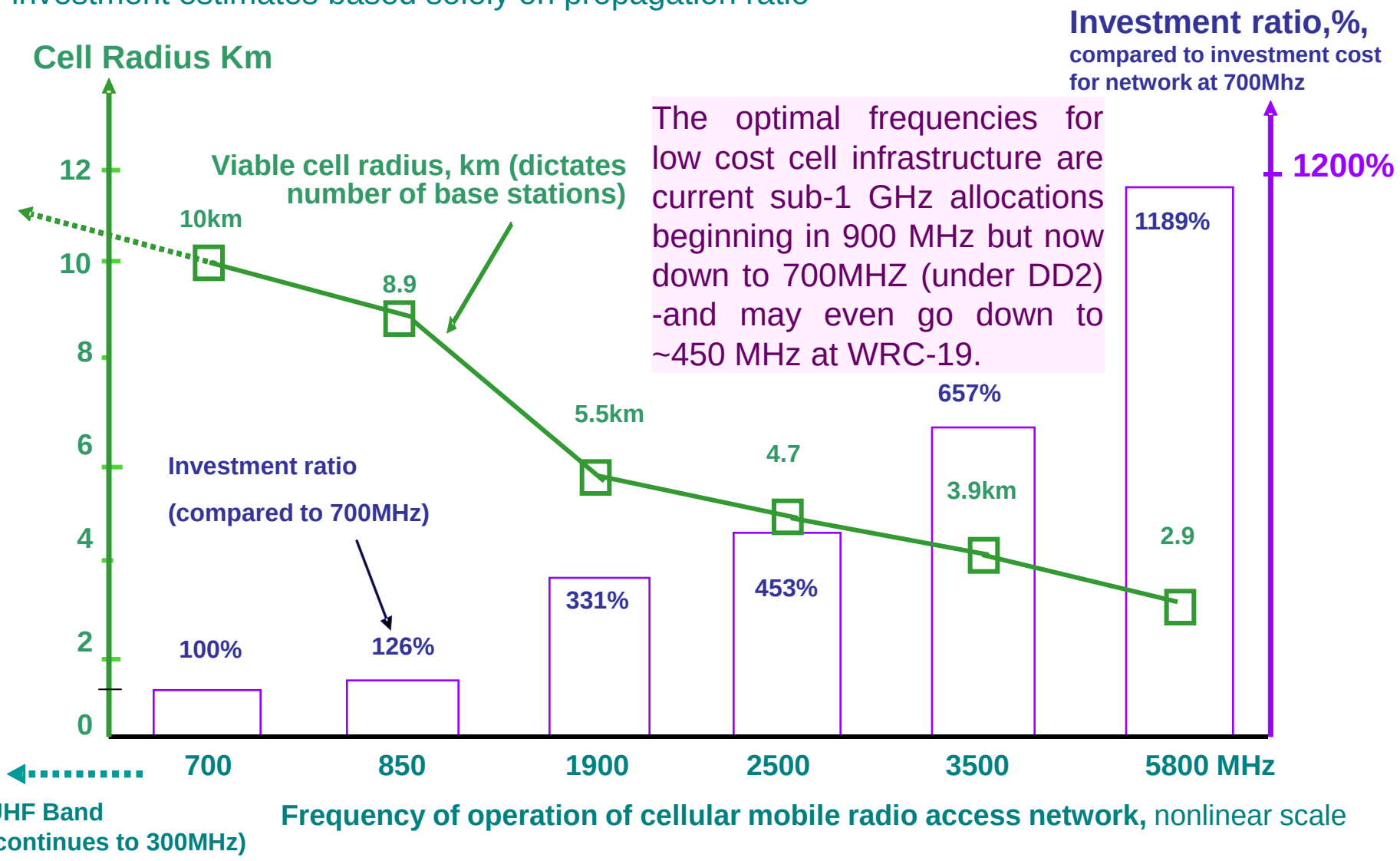
• Computing technology applied to radio comms has taken us well past the situation when it began around 1905 in Morse code and problems of interference were first seen, in ships' distress calls – similar to the 1920s for first radio broadcasting - so new freedoms

• WITH an explosion in spectrum uses, and users are crowding into an apparently full spectrum

•Yet the MNOs want it all !! - for mobile broadband data

Why are lower UHF frequencies so valuable ?

Propagation range varies with frequency - which controls infrastructure cost - simplified investment estimates based solely on propagation ratio



Sources: SCF Associates Ltd estimates for investments based purely on base station numbers per unit area, with the cell radius data with frequency quoted from BBC R&D, 2007, using Intel analysis.

The allocation and assignment processes are changing rapidly – at sectoral and at international level

•Over the last 100 years, spectrum regulation has grown up with strong mandates for *exclusive licences* in allocated bands

•Dominant users have been (and are):-

- Government - spectrum without restrictions or fees
- Broadcasters - exclusive spectrum licences at below market pricing
- And a 3rd entrant since 1980s - the mobile industry incumbents

• At sectoral level - meaningful media-telecoms- internet convergence just beginning:-

- •Telcos try to acquire media distributors and content providers to become the next 'broadcasters' for non-linear IPTV
- Media/content providers build own CDP platforms and consider IPTV for SVOD and fight for net neutrality for content delivery
- ISPs (Google, Facebook) and software (MS) move into spectrum demands

•Global harmonisation is being revised by emerging new global centres of economic power (EG China and developing world) with new priorities for allocations, upsetting the status quo in the international spectrum management forum and leading to a new pattern of spectrum allocations, eg in Africa - changes balance of ITU regional power

To plan. realistic expectations of growth of mobile data over next decade needed – strong implications for spectrum policy

Recent demand for spectrum is specifically being driven by enormous estimates for mobile broadband data – claim 2GHz needed -& really sub-3GHz:

•Controversy on accuracy - largely technocentric - less on socio-economic factors

•**Realistic assessment necessary** - as forecast of demand for the next decade. For reality to intrude, 3 key foundations for sensible estimates –

1 Socio-economic factors of demand - development rate determines market size through demand and take-up growth rates, which can be defined by three main variables:-

- •Total national population size (ie the level of potential saturation) with 10 year growth
- •User population topography –urban, suburban and rural - with user density for each
- •Resultant maximum traffic *density.*
- ***•Needs Analysis required*** (not really an ITU approach or the suppliers/marketeers)

2 Technology development *:* tends to reduce spectrum required – efficiency & re-use

3 Forecast regulatory interventions – will reduce net NEW spectrum needed as permit sharing of existing spectrum and also increase refarming (AIP) releases

Spectrum forecasting requires socio-economic needs analysis

Unfortunately these demand -side factors are too often ignored in both ITU and industry estimates* which include:-

- National economic development in terms of technology usage levels and user population growth rates –ie more advanced and realistic user scenarios for demand

- Ability of the economy to absorb and use new radio technologies

- Affordability levels – disposable income levels of user population compared with tariffs

- Uses of nomadic and mobile radio technology – social networking, remote working, etc which show up in needs analysis

- User segmentation in needs analysis – originally simple residential and business but now more sophisticated, by: demography – age; social class- ‘digital literacy’ and disposable income; locations and times of use (indoor, outdoor, home, school, office, driving, etc).

*from ICT suppliers such as Cisco and the marketeers such as ABI and Yankee

Consequently the range of spectrum allotment approaches has broadened - class by increasing freedoms to access spectrum - 8 key types, at least

1.Exclusive use by administrative decision (fiat) - either a donated licence or rights (in perpetuity perhaps) to use the spectrum band
2.Exclusive licence sold at auction with restricted to buyer exploitation only
3.Exclusive licence via auction with **tradeable conditions**, depending on NRA agreement and certain rules – eg geographic restrictions. Licensed shared access (**LSA**) may be used here.
4.Exclusive licence by auction with no conditions restricting secondary trading or sharing– LSA may be used here – effectively a ***private commons***
5.Various schemes based on software radio front-ends and cognitive radio (CR) to enable use of any available spectrum on demand in real time in a specific band, be it shared or exclusive – "**dynamic spectrum access**" (DSA) or "dynamic spectrum management" (DSM) - temporarily gives access to users of any band included, selected by time and geography[1]
6.Various schemes to use interstitial narrow frequency bands – usually '*white' spaces* between TV channels without interference. Offers narrowband low speed data streams usually.
7.Techniques using very wide bandwidth emissions to form low power signal at a single frequency - may be termed an ***underlay*** signal - amplitude comparable to noise levels at any one frequency.
8.Licence exempt* (LE)** bands to enable complete sharing of spectrum using variousconditions. Such schemes may have rules governing interference and techniques to avoid that such as power levels and duty cycle, and CR style LBT protocols. LE swathes form a ***public commons – the basis of Wi-Fi, Bluetooth and the ISM bands.

[1] See related reports: from the EU, *Perspectives on the value of shared spectrum access*, Final Report for the European Commission, February 2012, Forge, S., R. Horvitz, C. Blackman, (2012), http://ec.europa.eu/digital- agenda/sites/digital-agenda/files/scf_study_shared_spectrum_access_20120210.pdf. Also from the USA - PCAST report (2012) *Realizing the full potential of government held spectrum to spur economic growth*, 20 Jul 2012, for US president

Opening of more LE bands favours development of new users – specifically the industrial use of radio – IoT, M2M networks

• Uses includes smart grids (eg using mesh networking), industrial logistics systems with RFID, building management, intelligent transport systems (ITS) for rail and road etc being targetted

•In the USA, the PCAST committee's recent report on refarming of Federal spectrum shows possibilities of opening far more spectrum for industrial and scientific instrumentation

•UK Ofcom consultation (2013) on unlicensed IMS bands of 870-876 MHz and 915-928 MHz illustrated release of unlicensed spectrum for intelligent control of smart electricity grids would tend to promote long term UK economic growth [1]

Value of industrial use spectrum far higher than returns from broadcast or mobile comms by factor of 5-10 times - Ofcom 2006 study[2] on LE:-

For licensed spectrum, economic value (2006, UK £)

- Mobile services £50Mn/MHz
- Broadcasting £29Mn/MHz.

Unlicensed applications

- Telemetry offered £300 Mn/MHz,
- RFIDs in retail £620Mn/MHz.
- Wi-Fi in-home and in-building £69Mn/MHz (2006 – now far more)

LE also favours consumer uses of radio - home area networks, automotive SRDs, etc

[1] Ofcom, stakeholders website : Consultation on 870-876 MHz and 915-921 MHz, Update and Way Forward, SCF Associates Ltd, 26 MARCH 2013
[2] Ofcom (2006) *The economic value of licence exempt spectrum*, Final report, Ofcom, Indepen, Aegis, Ovum

Basic change

- move away from serving needs of the traditional dominant players

Implies a move away from serving the needs of the traditional dominant forces in spectrum use until now - government, broadcast, & mobile industry incumbents

•With digital switchover for TV - analogue to digital - potential for freeing up many frequencies in the most valuable part of the radio spectrum

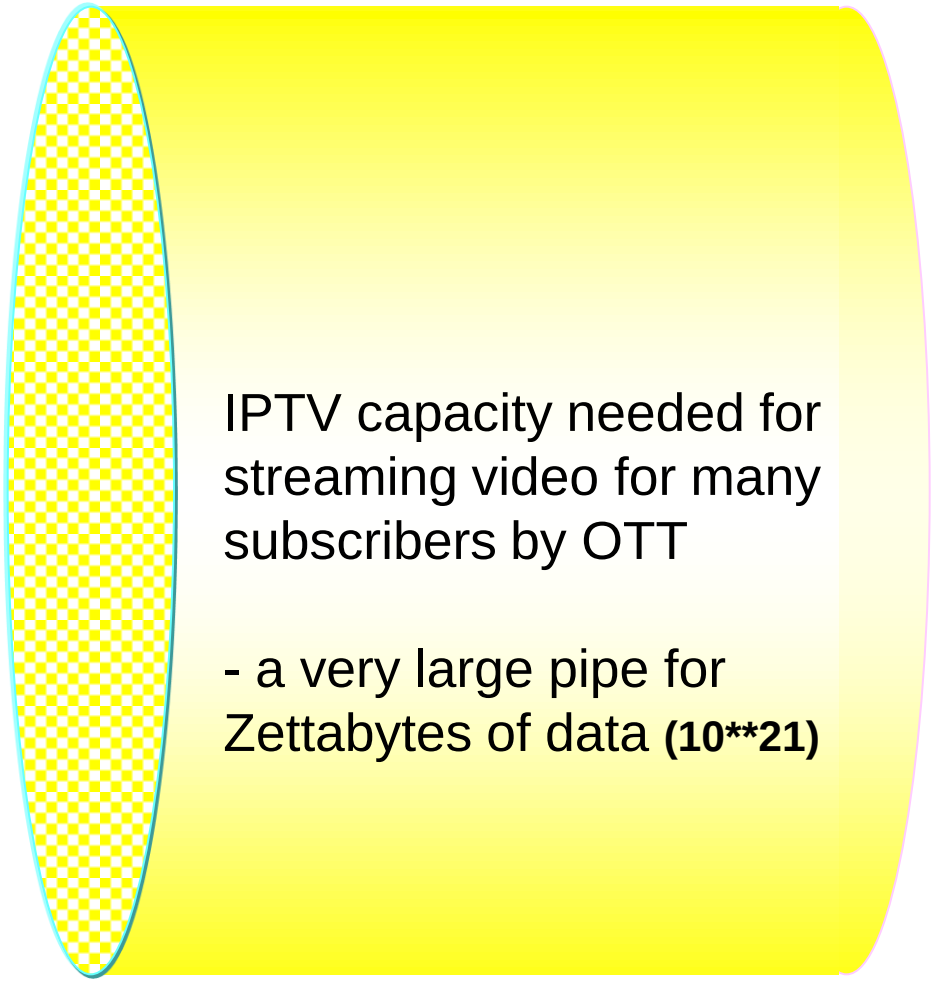
•Next step is for broadcasters - may move to IPTV and broadband delivery, or SFNs – with both more spectrum can be refarmed (FCC incentive auctions used in USA)

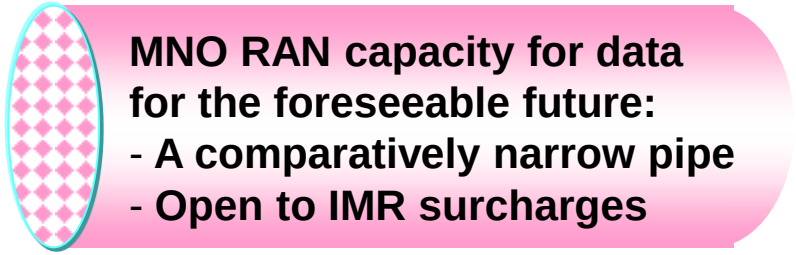
•Refarm exclusive bands for government to serve the whole economy -use AIP and other incentive mechanisms to promote relinquishing and sharing spectrum, to the benefit of the private sector.

•Interfering signals as a distortion or loss of information transmitted is increasingly being mitigated by the new technologies, so that more simultaneous applications and users can be served. This is driving the general principle of unfettered sharing especially with further licence exempt bands.

•Thus NRA should be concentrating on receiver characteristics to counter interference rather only restrictions on the transmitter's performance, principally power. This principle can be applied for setting conditions for licensed use but is just as important for LE device permissions for unlicensed sharing. EG today overlapping Wi-Fi signals are constantly used.

The real question of mobile broadband - is a 2-pipe problem





Near 200 Exabytes in 2018 (approx 12% of 1.6 ZB, Cisco)

Eventual technical solution may only be fixed or Wi-Fi, or perhaps **5G for short range broadband networks = urban usually**

Current mobile technical solutions, even with LTE Advanced, may continue to be the rule outside urban environments

The question of mobile broadband needs a 3-pipe solution

IPTV capacity needed for streaming video for many subscribers by OTT

- a very large pipe for Zettabytes (log scale) of data **(10**21)**

Eventual technical solution may only be fixed or Wi-Fi, or perhaps **5G for short range broadband networks** = **urban usually**

MNO RAN capacity for data for the foreseeable future:
- **A comparatively narrow pipe**
- **Open to roaming surcharges**

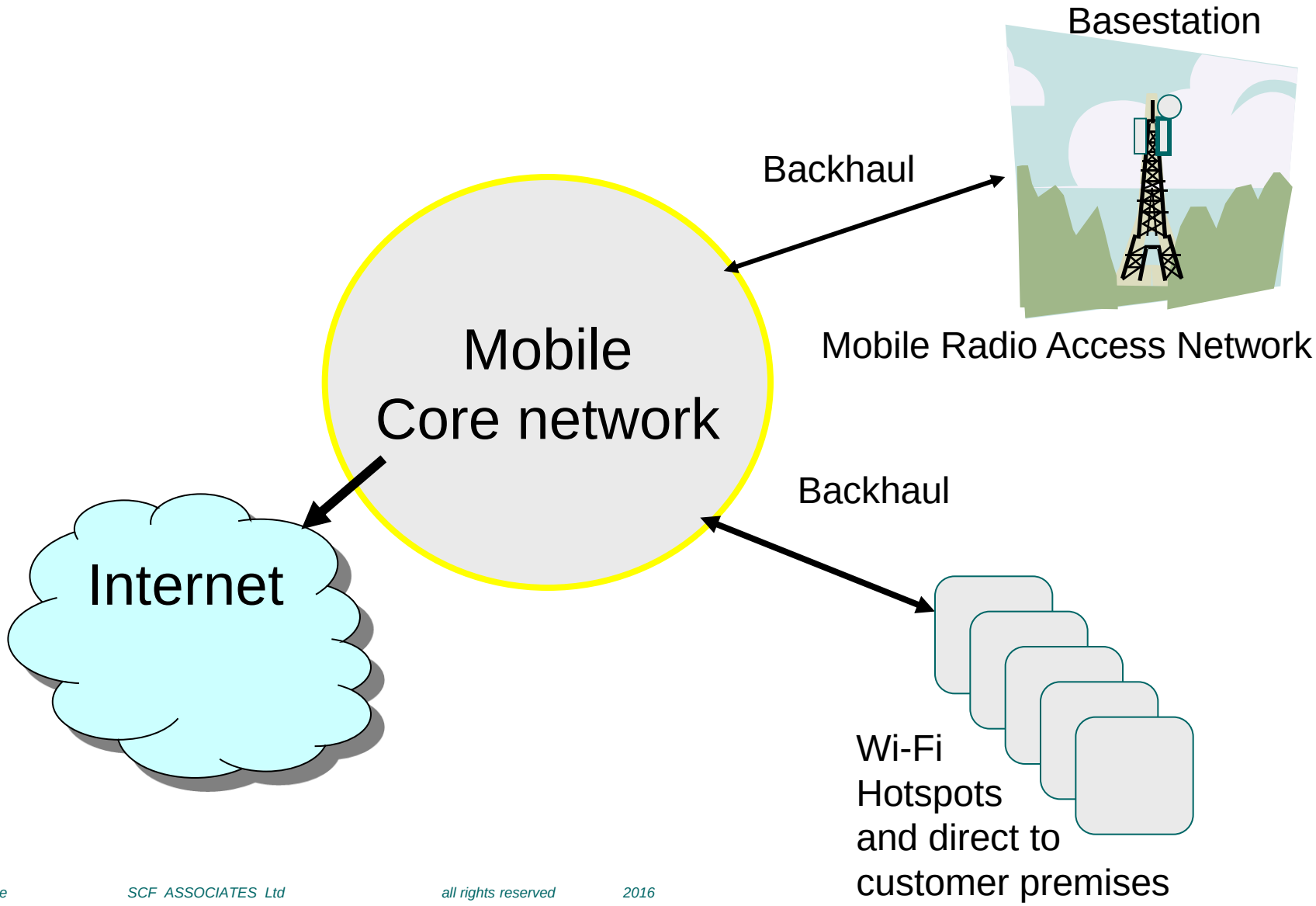
Near 200 Exabytes in 2018
(approx 12% of 1.6 ZB, Cisco)

MNOs (& others) commit to data offload option – Wi-Fi:-

- **Over fixed line (broadband)**
- **Over Wi-Fi WAN & MAN (eg Relish, London) & possibly new Wi-Fi bands <700MHz**
- **OTT level tariffs international**

MNOs may use offloading to Wi-Fi – even wide area MANs as technical solutions, **so may need to reconsider Wi-Fi allocations in the future**

The mobile Internet - embraces offloading data traffic from mobile - a key strategy for many MNOs serving the ‘nomadic market’



Next steps for policy

•Fundamentally expect progress to drive transition for assignments from:-

- Administered managed approaches, beauty contests , market-based (auctions) with some secondary trading

•To:-

- Sharing of licensed assignments with LSA and similar
- Finally to more Licence Exempt (LE) spectrum.

•That will call for a new form of NRA to organise and facilitate maximum use of the spectrum.

•As a more general principle, NRAs should operate by setting the least restrictive conditions, in order to increase the availability of useful spectrum. That will promote innovation and offer greater flexibility in usage. However international harmonisation of the radio spectrum must also be considered.

•Consequently the NRA must seek a balance between no restrictions and harmonisation, in order to encourage standardisation and so promote the economies of scale in manufacturing to lower the costs of radio equipment and international services.

•The NRA will use economic policy and social benefits far more, because spectrum management is really concerned with industrial development and mass consumption today.

•Thus socio-economic cost-benefit analysis and needs assessments should guide spectrum planning as well as the detailed implementation, specifically when market mechanisms do not work satisfactorily or in a comprehensive manner.

Spectrum planning should be placed in a socio-economic context - so *demand analysis* governs spectrum allotment, especially when considering new uses.

If such analysis shows that there is a risk of harm to competition when re-assigning or in using spectrum, competition-promoting measures that restore strong competition should be included in decisions about assignments and usage conditions (including licence conditions).

A further guiding principle is that the ***collective use*** of spectrum will tend to expand:

Existing licensed spectrum may be progressively prepared for sharing, with licensing taking account of the varied possible forms of collective use in the future.

Thus most frequency bands will be shared in the long term

For instance, co-primary (equal) users for sharing licensed spectrum, or with a primary & 2ndary user, should also be considered - LSA agreements point to this

At a detailed level, large-scale sharing requires:-

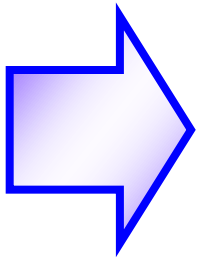
- Comprehensive technical rules
- Concentrated radio spectrum planning
- Well-defined receiver characteristics
- Competition-neutral harmonisation

Spectrum sharing requires strong conformance to rules for interference elimination

Strategy for usage – a new regulatory regime?

The old (and current) regime of spectrum regulation

- Forbid everything
- Only permit explicit exceptions



The new regime

- Allow anything
- Only forbid in explicit cases

Regulator role	Controller and commander	Co-ordinator and facilitator
Decision Criteria	How many users	How much interference
Basis for decision	Marketable property – restricted economic benefit from sale	Publicly owned commodity - widespread economic benefit from sharing

General Implications for regulators – co-ordination and guidelines

1. Reshape existing licences (for all forms of spectrum management)
   - Subletting clauses for sharing – LSA- move from exclusivity & auctions
   - Move to Licence Exempt, LE (– more for *nomadic* than mobile)

2. For public sector spectrum with command and control licences:-
   - Incentives to sublet/share, eg AIP - refarming for commercial use
   - Incentives to relinquish spectrum *for commons* emphasised (AIP)
   - First requires technical audits of holdings and then of efficient usage in periodic reviews for those with mandates on their spectrum
   - Incentive auctions will also be used in private sector to encourage broadcasters to relinquish spectrum as move to IPTV & SVOD

3. Auctions will be complemented in the future by sharing and move to LE so gradually move away from effort only on auctions, lotteries, etc,

   - Have too often been used by governments as cash cow
   - Key role for MNOs with 'deep pockets' in creating oligopolies
   - Future - more towards social and macro-economic value of spectrum

*European Commission (2012) *Perspectives on the value of shared spectrum access*, SCF Associates Ltd

General Implications for regulators – co-ordination and guidelines

5. More “active” regulatory role for NRAs in deployment of *licence exempt* radio technologies:-

   - Greater international co-operation for harmonised LE allocations
   - National interference monitoring programmes
   - Type testing laboratories and rigs for interference level conformance, for pre-set power, duty cycle and pass-band frequency specs

6. New parts of the spectrum being used:-

   - IoT – lower frequencies (VHF to LF) and higher than UHF
   - 5G – higher - Centimetric & Millimetric for higher density small cell, from 6GHz - 100GHz – but perhaps more expensive networks specifically for dense urban environments

As far as possible, measures taken by NRAS should be future-proof and viable across different future scenarios.

•NRAs must understand impacts of spectrum decisions on the whole national and regional economy – not just the vested interests of specific players or sectors

•That will be paramount in taking spectrum management decisions for an asset that will surpass hydrocarbons as an essential ingredient of a thriving economy.

•Thus NRAs should be prepared to forecast & deliberately experiment.

•Compare impacts of various choices on different types of usage rights, conditions of use & processes of implementation

• Use formal impact assessments, ex ante and ex post - eg to assess measures for rapid growth in society's demand for radio applications, as new applications / improved technologies enter

•Assess real impacts on spectrum management of new technologies and applications in terms of

- •Social impacts, including health
- •Economic significance
- •Pure spectrum effects - such as substitution

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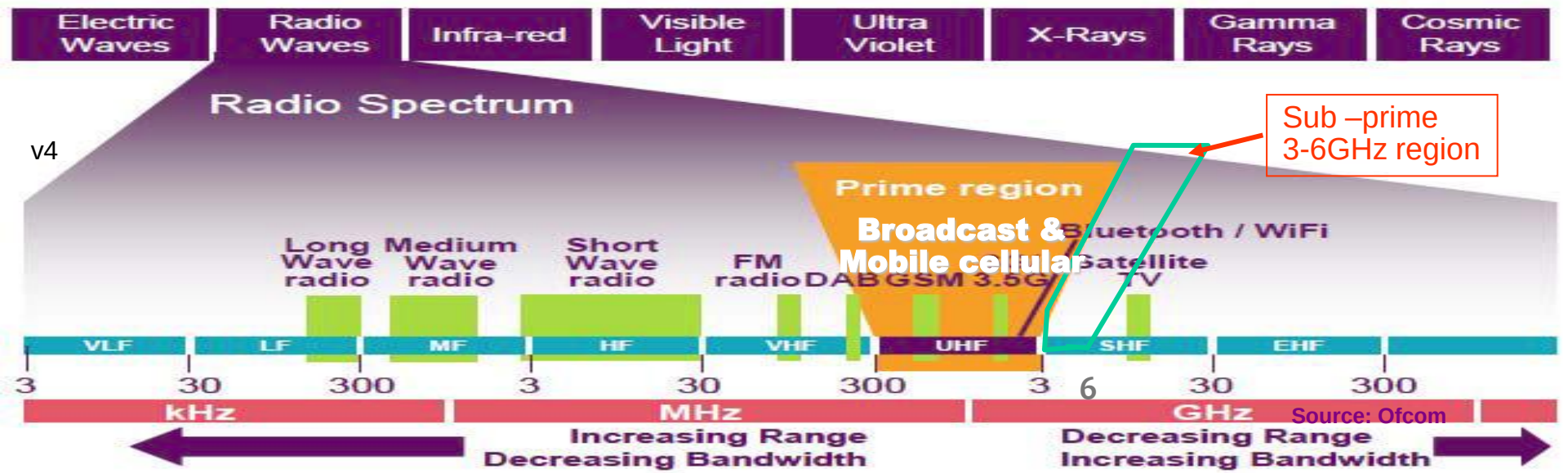
Policies for spectrum management

Thank you

Simon Forge May 2016



Session 4

Panel discussion: the future of fixed and mobile broadband policy

Bangkok, 3 May 2016

Session 5

The network neutrality debate and the dynamic Internet

Andrea Renda

Bangkok, 4 May 2016

Once upon a time there was the Internet

- **Originally designed as “neutral”**
  - **All bits are created equal**
  - **“Like Central Park After Dark” (Carol Rose)**

Peter Steiner. The New Yorker, July 5, 1993

"On the Internet, nobody knows you're a dog."

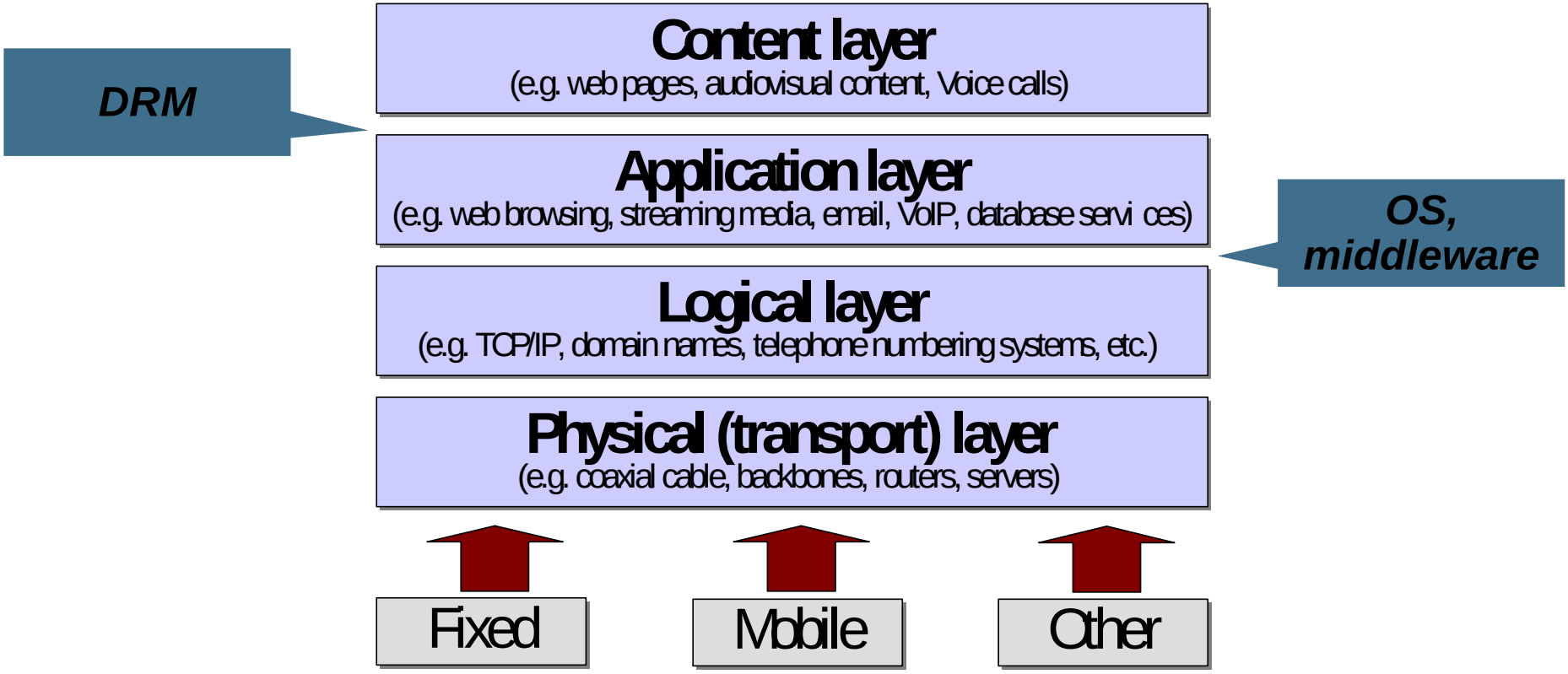
Pre-historical legal landscape

- **United States**
  - **1996 Telecommunications Act**
    - **Internet is an information service, thus almost unregulated**
  - **1998 DMCA**
    - **ISPs are not responsible for the conduct of their subscribers**
- **In Europe, a few years later, a similar approach prevailed (2000 e-Commerce directive)**

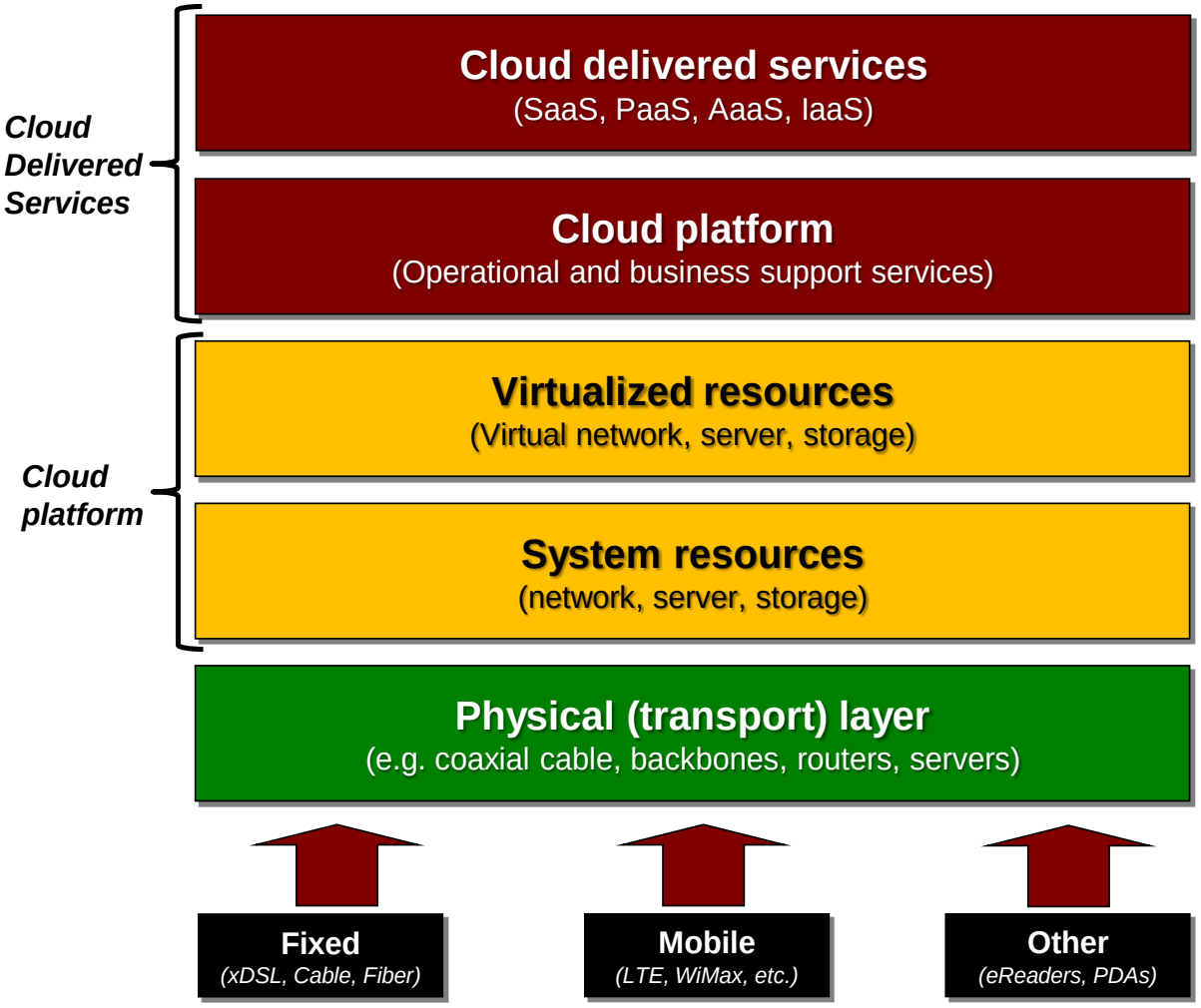
Once upon a time there was the Internet

- **Originally designed as “neutral”**
  - **All bits are created equal**
  - **“Like Central Park After Dark” (Carol Rose)**
  - **Underlying open standards have been the key to this development**
- **The more it becomes critical, the less it can remain neutral?**

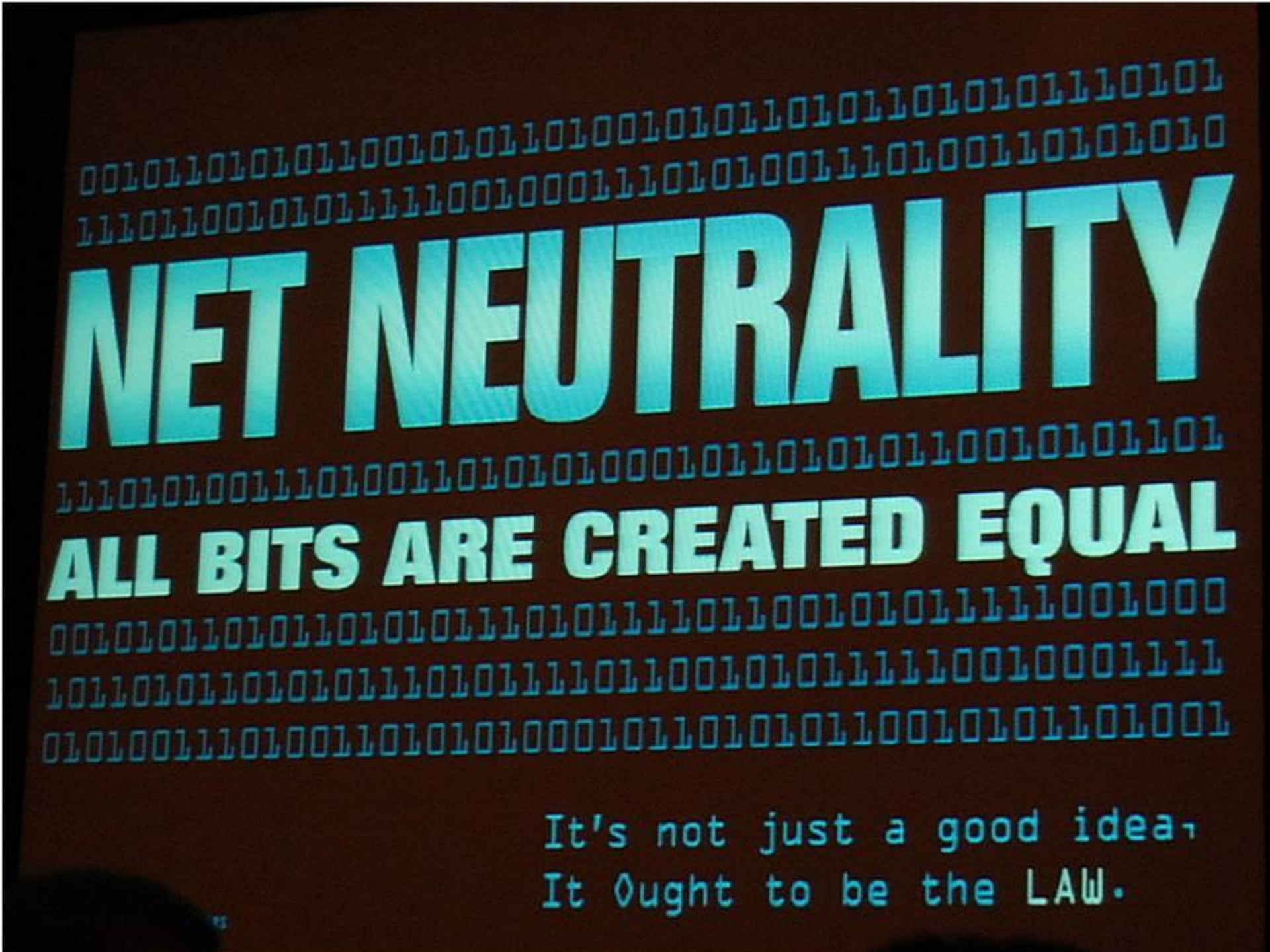
UNDERSTANDING THE ICT ECOSYSTEM



UNDERSTANDING THE ICT ECOSYSTEM




Should the Internet have toll lanes?


NET NEUTRALITY
ALL BITS ARE CREATED EQUAL
It's not just a good idea.
It Ought to be the LAW.

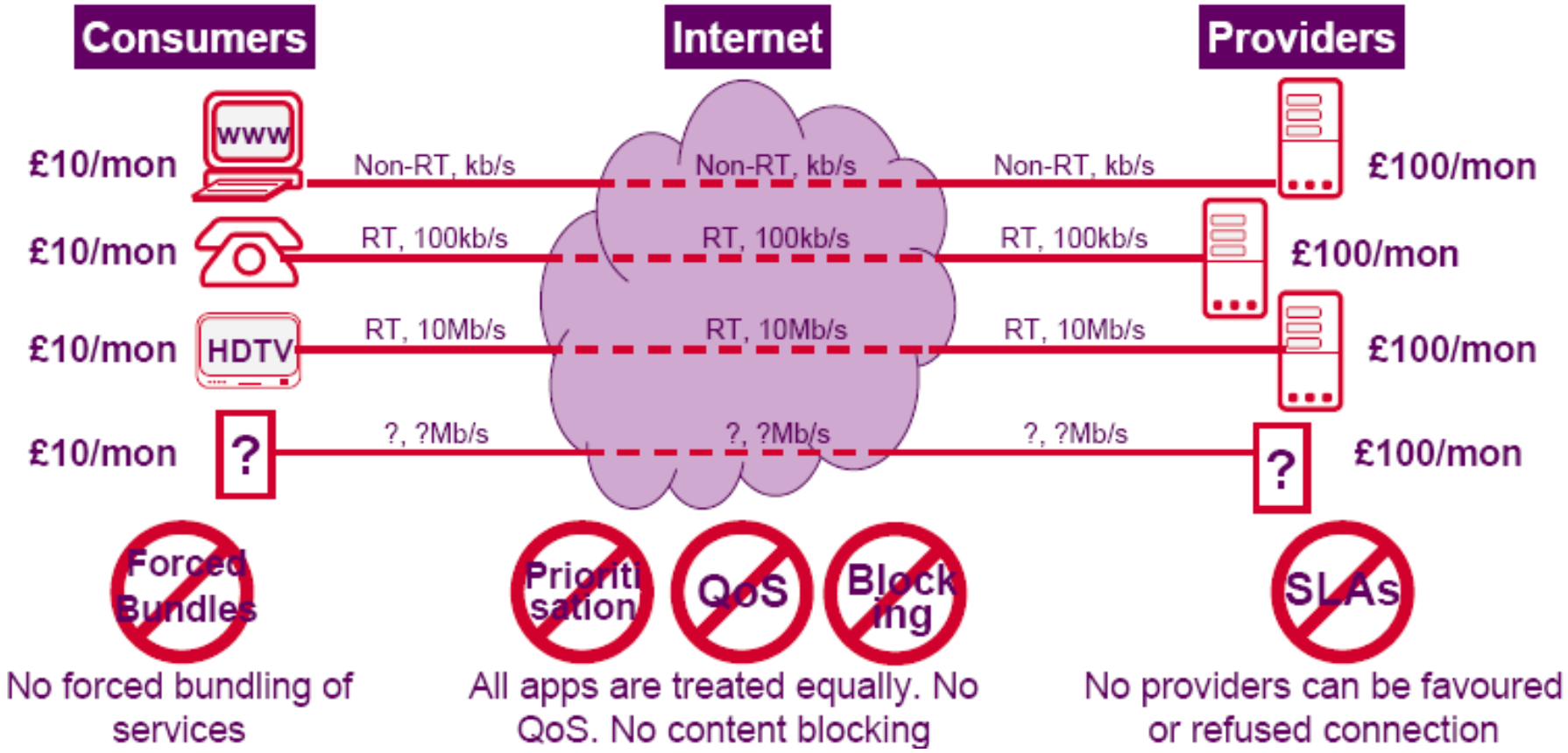
A NEVER-ENDING DEBATE (I)

- **Net neutrality advocates**
  - ISPs may have an incentive to block applications or intentionally degrade competitors' quality, thus foreclosing competing IAPs ("Madison River" argument)
  - All bits should be treated equally: no access-tiering, no blocking of applications, no traffic shaping
  - Without mandatory NN, the Internet would lose its revolutionary potential ("next Google" argument)
  - Traffic management and DPI on the Internet can hinder freedom of expression and privacy

A NEVER-ENDING DEBATE (II)

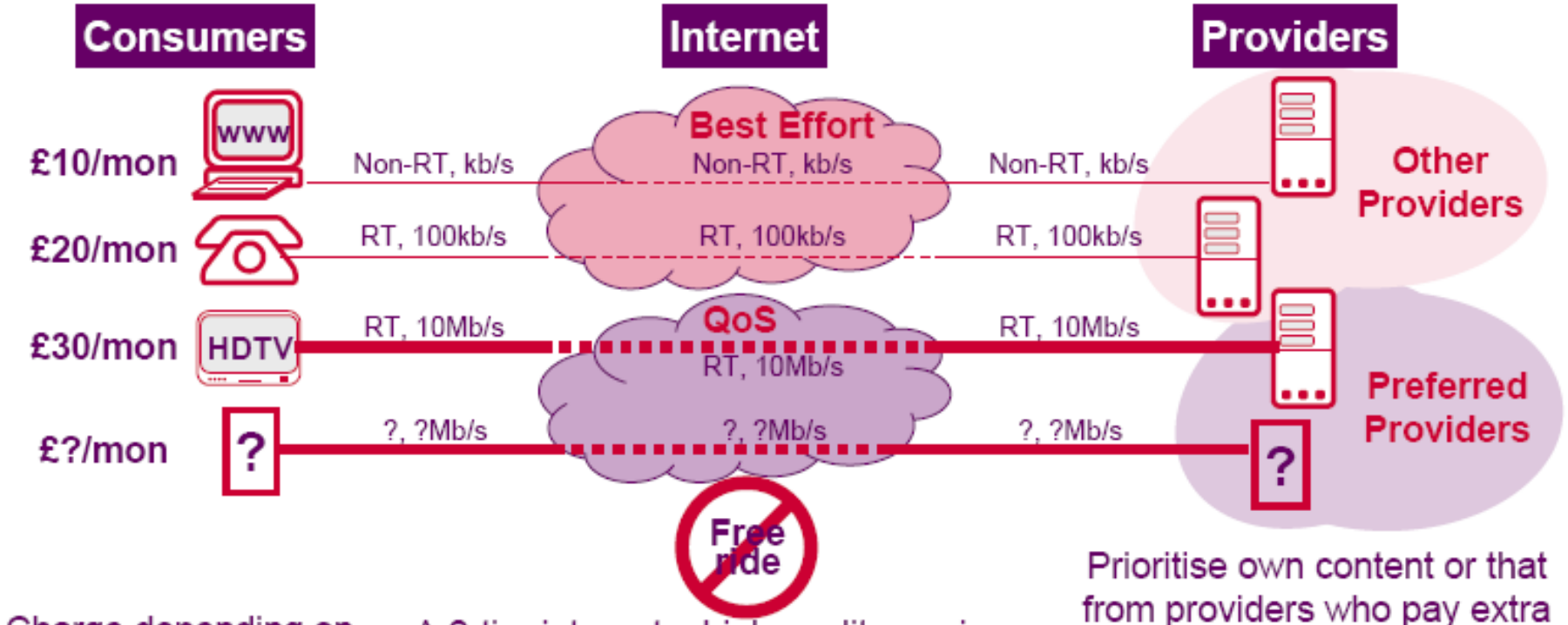
- **Convergence = congestion**
  - Real-time applications (VoIP, online gaming, etc.)
  - Interactive applications (Web browsers, etc)
  - High-duration file transfer applications (P2P, etc.)
- **Network management => product differentiation**
  - Low-bandwidth users must not cross-subsidize “hogs”
  - Users should choose the offer that fits best their needs
  - Platform users must contribute to setting up the service
- **No market failure** (“why fix what ain’t broke”**)**
- **“We need to enforce copyright”!**

VISIONS OF THE INTERNET WORLD (I)



Source: Ingram (2007)

VISIONS OF THE INTERNET WORLD (II)



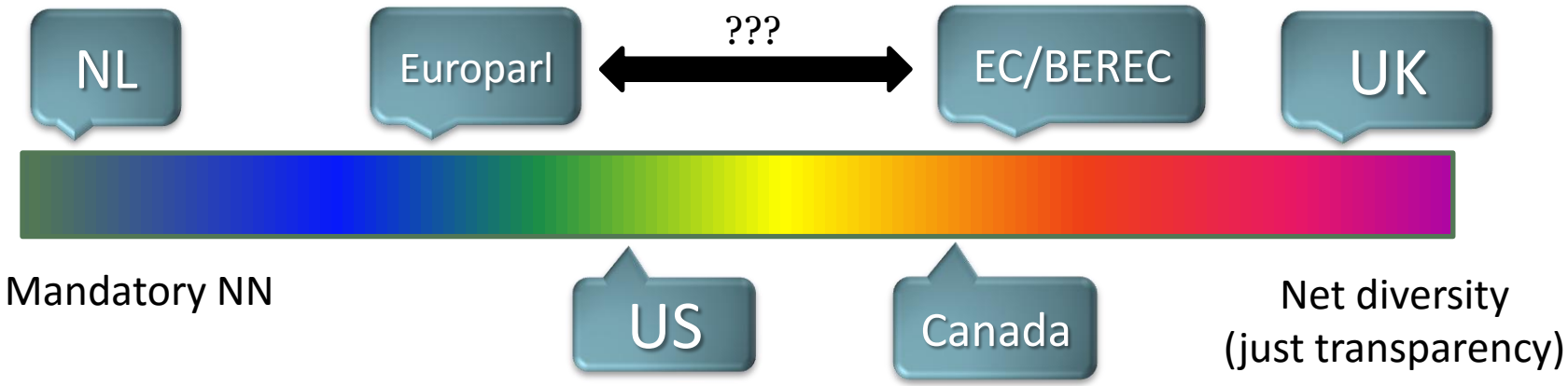
Source: Ingram (2007)

A MULTI-DIMENSIONAL DEBATE

- **Technical dimension**
  - Network congestion and traffic shaping
  - Some traffic is more time-sensitive and QoS-sensitive
- **Competition dimension (static efficiency)**
  - Integrated players v. nomadic players (OTT)
- **Dynamic efficiency dimension**
  - Incentives to invest in NGNs
- **Consumer protection dimension**
  - Consumer access to content on the Internet (“ACATAWAD”)
- **Neutrality as media pluralism**

The Net neutrality spectrum

- **Over the past decade, several countries have taken action on net neutrality**
- **All of them imposed transparency, but there is wide divergence on "reasonable" traffic management**



- **Is this divergence plausible given the global nature of Cyberspace?**

NET NEUTRALITY IN THE US (1)

- **Open Internet principles 2005**
  - **Consumers deserve access the lawful Internet content of their choice.**
  - **Consumers should be allowed to run applications and use services of their choice, subject to the needs of law enforcement**
  - **Consumers should be able to connect their choice of legal devices that do not harm the network**
  - **Consumers deserve to choose their network providers, application and service providers, and content providers of choice.**

NET NEUTRALITY IN THE US (2)

- **Open Internet Order 2010**
  - **Very few exceptions to the net neutrality principle**
  - **Wireline ISPs are subject to obligations of**
    - **Transparency**
    - **No blocking**
    - **No unreasonable discrimination**
  - **Very light approach on mobile**
  - **At the same time, “regulatory holidays” for high speed broadband were granted at the infrastructure layer since 2003**

NET NEUTRALITY IN THE US (2)

- **D.C. Court of Appeals in *Verizon v. Netflix (Jan 2014)***
  - **Vacated much of 2010 FCC order, but recognized FCC's competence on the Internet**
  - **ISPs should have the right to negotiate specialized services with "bandwidth hogs"**
  - **A wave of new agreements between Netflix and Comcast, AT&T, and Verizon**

NET NEUTRALITY IN THE US (3)

- **Open Internet Order 2015**
  - **Broadband access reclassified under Title II of the 1996 Act**
  - **ISPs cannot engage in**
    - **Blocking:** *a person engaged n the provision of broadband Internet access service … shall not block lawful content, applications, services, or non-harmful devices, subject to reasonable network management*
    - **Throttling***: a person engaged n the provision of broadband Internet access service … shall not impair or degrade lawful Internet traffic on the basis of Internet content, application, or services, or use of non-harmful device, subject to reasonable network management*
    - **Paid prioritization***: a person engaged n the provision of broadband Internet access service … shall not engage in paid prioritization. The latter refers to the management of a broadband provider's network to directly or indirectly favor some traffic over other traffic…*
  - **The rest is subject to a general standard of non-harmful interference**

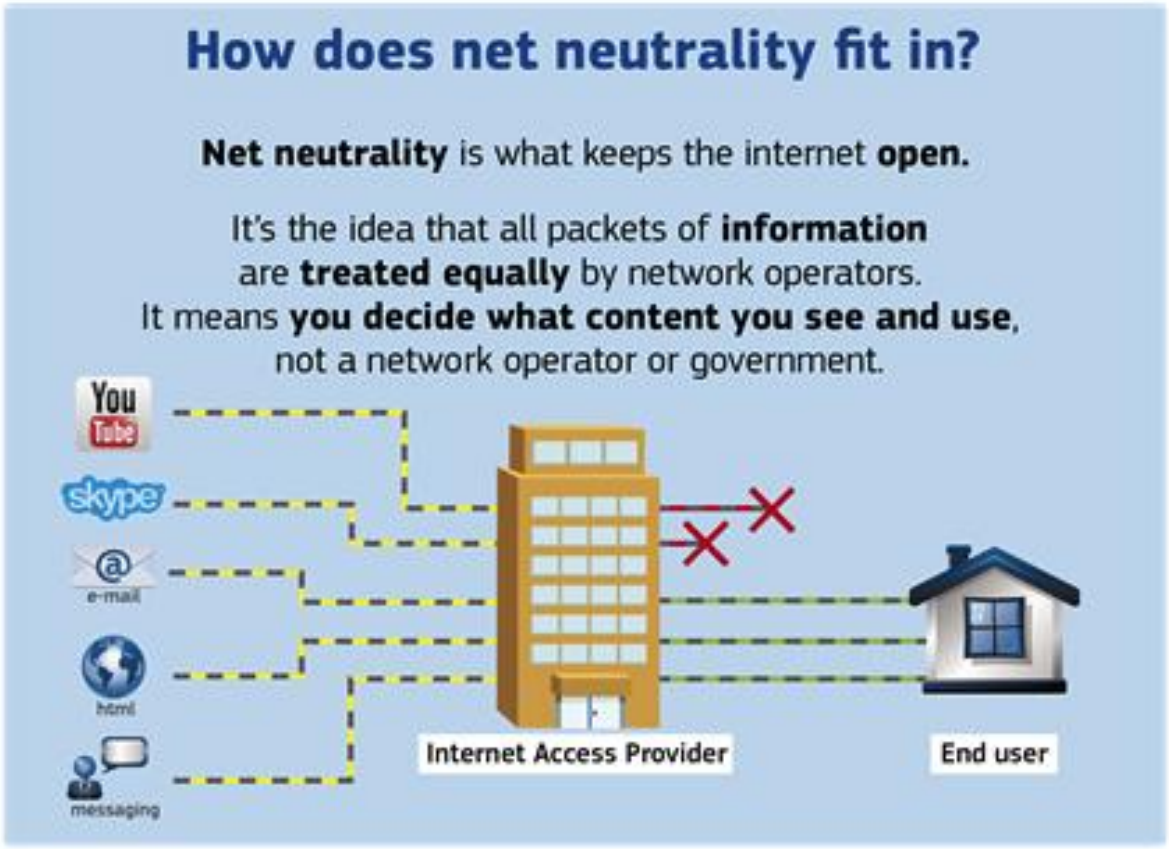
NET NEUTRALITY IN THE US (4)

- **Open Internet Order 2015**
  - **It applies to wireline and wireless in the same way**
  - **FCC announced its intention to exercise self-restraint by adopting a very narrow approach to Title II: this means that as many as 27 provisions in Title II ad more than 700 other relevant FCC regulations will not apply to BIAS**
  - **At the same time, ISPs will be able to offer non-BIAS. Will this affect the direction of investment?**

STATE OF PLAY: EU LEGISLATION

- **European Union: revision of the telecoms package**
  - **Transparency** (Amended Art. 20 USO Directive) end users have to be clearly informed of limitations imposed by ISPs on their ability to access any content and/or run any lawful application or service of their choice.
  - **Minimum QoS** (Amended Art. 22 USO Directive). NRAs can intervene to set minimum QoS standards whenever ISPs degrade quality to an unacceptable level, "thereby frustrating the delivery of services from third parties".
- **COM(2011)22**
  - No need for additional guidance for the time being
  - Commission will monitor developments with NRA

CONNECTED CONTINENT (I)



CONNECTED CONTINENT (II)

- **But the Commission left the door open**
  - No discriminatory blocking and throttling
  - Traffic management on the Internet must be non-discriminatory, proportionate and transparent.
  - Content providers and internet providers might sign deals to assure a certain QoS (“specialised services”). This will enable telcos to generate additional revenue streams from OTT actors, content providers as well as from consumers
  - BUT: Specialised services must not lead to quality degradation of the "normal" Internet

CONNECTED CONTINENT (III)

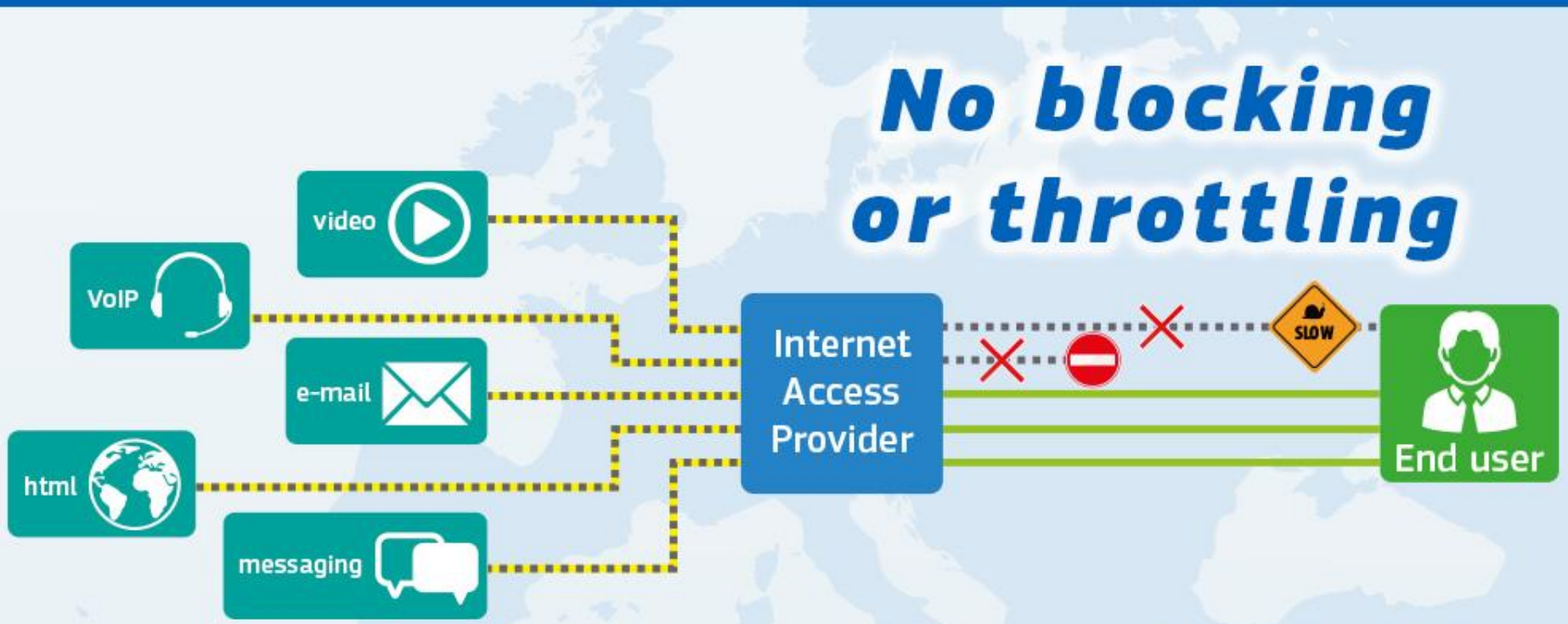
- **Practical application might prove highly complex**
  - When is the open Internet sufficiently impaired?
  - QoS means different things to different users and different services
  - How can transparency obligations become more user-friendly?
  - Risk of market micro-management?

CONNECTED CONTINENT (IV)

- **Subsequent developments**
  - In April 2014, the European Parliament vote on Connected Continent restricted significantly the possibility to launch specialized services
  - Since then, the trilogue with the Council has led to positions that are closer to the original view of the Commission
  - The final decision largely confirmed the Commission's original position

European Commission

Net neutrality in the EU



Every European must have access to the open Internet

All Internet traffic will be treated equally

REGULATION 2015/2120

- **Applies as of 30 April 2016**
  - **Blocking, throttling and discrimination of internet traffic by ISPs generally not allowed**
  - **Three exhaustive exceptions**
    - Compliance with legal obligations;
    - Integrity of the network;
    - Congestion management in exceptional and temporary situations)
  - **IAPs will still be able to offer specialised services, so long as they are not supplied at the expense of the quality of the open Internet.**

NET NEUTRALITY IN THE EU: FIVE SYNDROMES

- **“First legislate, then think”**
- **“Galileo” syndrome**
- **“Trabant” syndrome**
- **“Keys and lamp post” syndrome**
- **“Stockholm” syndrome**

Why did we want neutrality in the first place?

- ~~Anonymity~~
- ~~Competition and fair business practices~~
- ~~Innovation~~
- ~~User choice~~
- ~~Openness~~
- ~~Freedom of expression/Pluralism~~

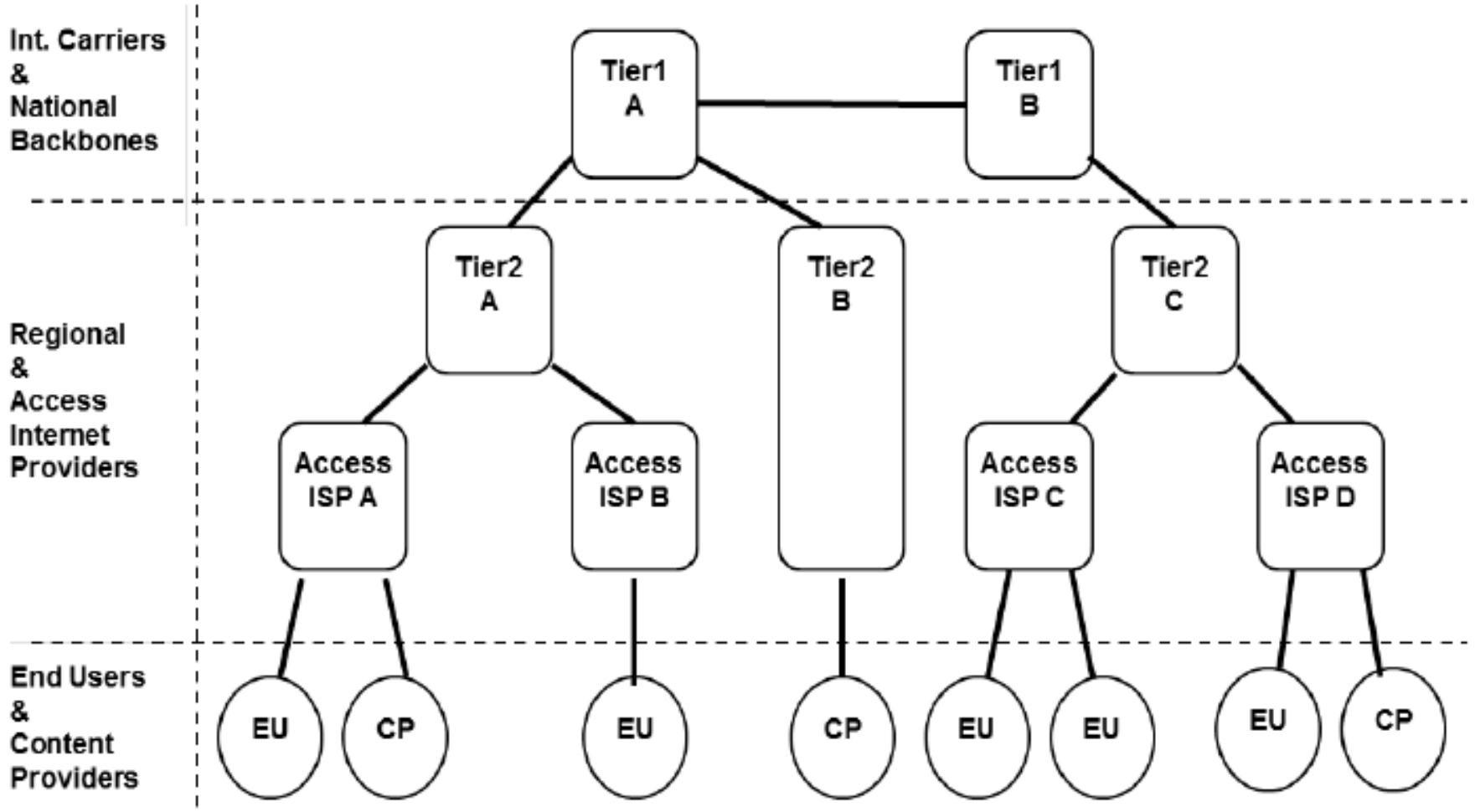
FIVE MYTHS...

1. **The net is neutral**
2. **Users always want a neutral Internet**
3. **Neutrality always helps start-ups**
4. **With diversity, QoS fees would be positive and supra-competitive**
5. **With diversity, market power would necessarily accumulate in the hands of ISPs**

The Internet is becoming flatter

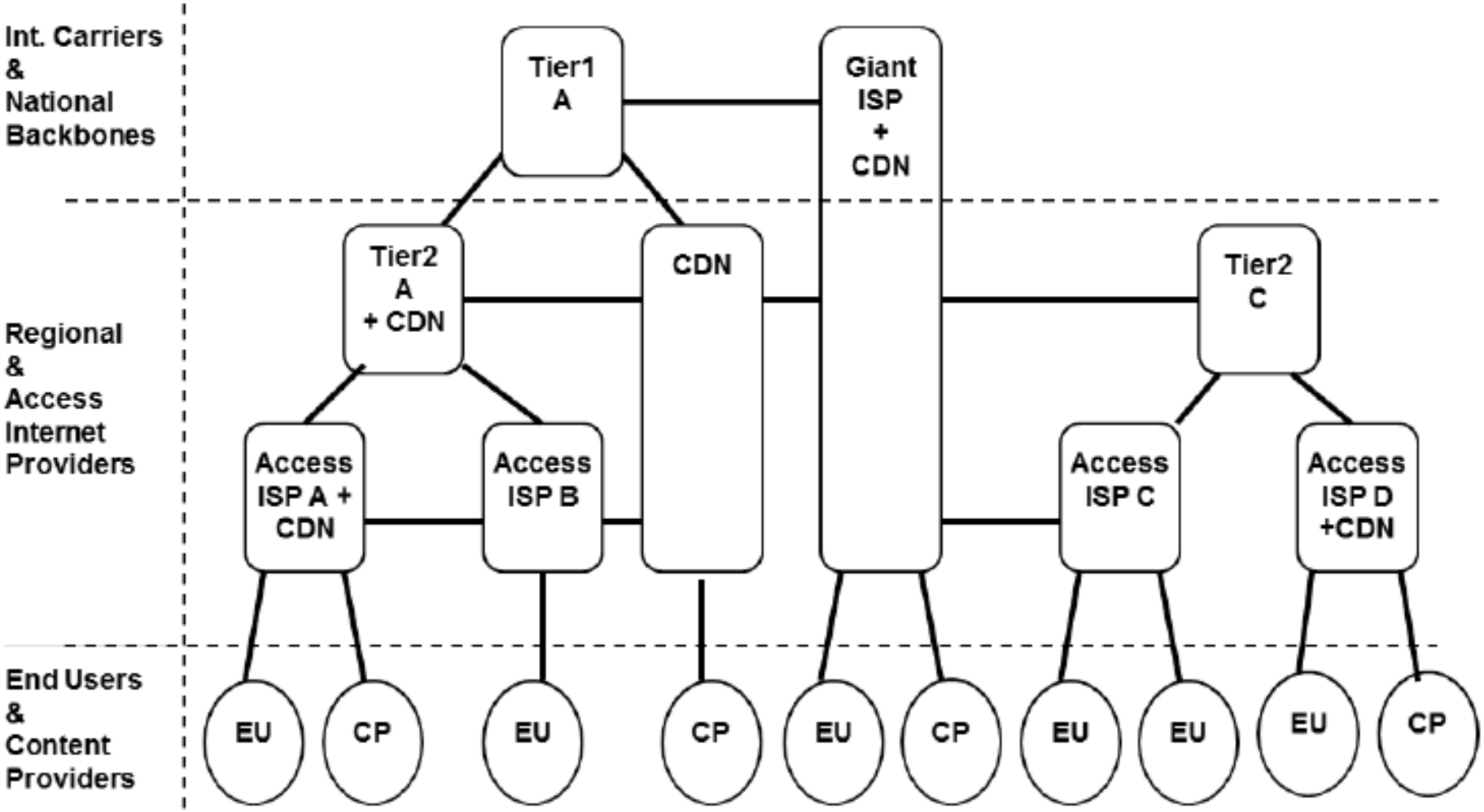
- "Platformization" (Clarke and Claffy 2013)
  - Rather low entry barriers
  - Prevalence of open models
  - Revenue sharing models (possible competition issues)
- "Flat Internet": an emerging market for QoS
  - A juxtaposition of infrastructures
  - Various types of CDN business models
  - Do they compete with potential QoS offers by ISPs?

THE INTERNET IS BECOMING FLATTER



Source: Palacin et al. (2013)

THE INTERNET IS BECOMING FLATTER

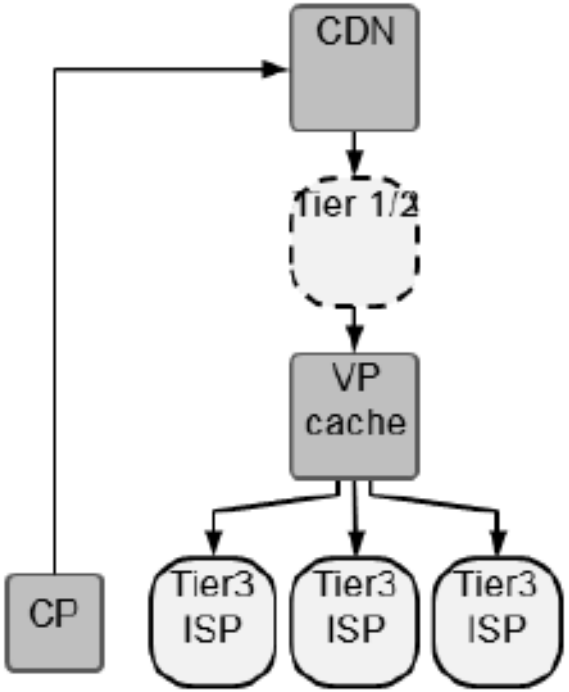


Source: Palacin et al. (2013)

THE INTERNET IS BECOMING FLATTER

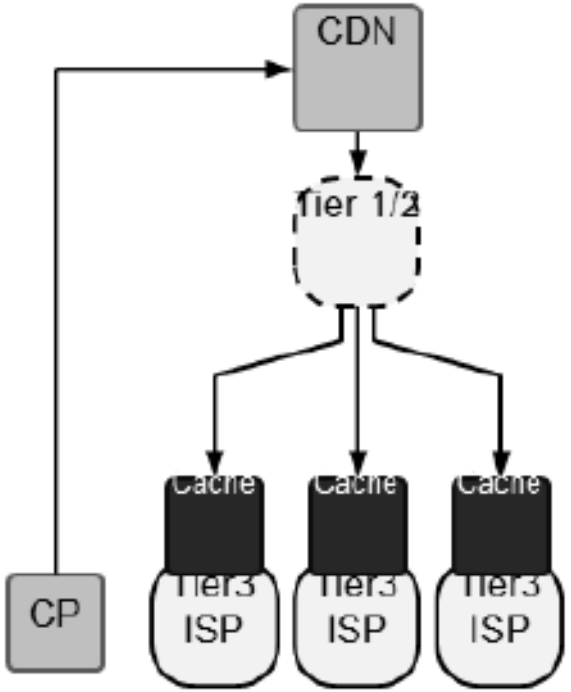
- **Emerging CDN strategies**

Example: Level3



[a] Vantage Point (VP)

Example: Akamai



[b] Inside Tier-3

Source: Palacin et al. (2013)

THE INTERNET IS BECOMING FLATTER

- **"Platformization" of traffic delivery: impact on entry barriers?**
  - **No level playing field? Large content providers commonly use CDNs in the distribution of their content while long tail content providers tend to use traditional hosting solutions**
  - **Hyper-giants tend to follow a two-sided market strategy: bloggers and newly born content providers can use existing free services such as Google Sites, App engine or Amazon Web Services**
  - **Centripetal force, again?**

Big Contradictions

- Imposing too strict neutrality rules can hamper traffic optimization (likely to become a bigger issue with 5G)
- At the same time, how could one implement a more flexible rule allowing for specialized services?
- Can ISPs be neutral and at the same time be made responsible for their subscribers' behavior?
- Online intermediaries (including search engines) cannot be neutral: if they were, they would be useless
- Online intermediaries cannot be obliged to act neutrally and also to filter traffic, protect privacy and children, combat hate speech and foster pluralism!

Peter Steiner. The New Yorker, July 5, 1993

"On the Internet, nobody knows you're a dog."

The economics of platforms: understanding competitive dynamics in the current Internet

Network externalities

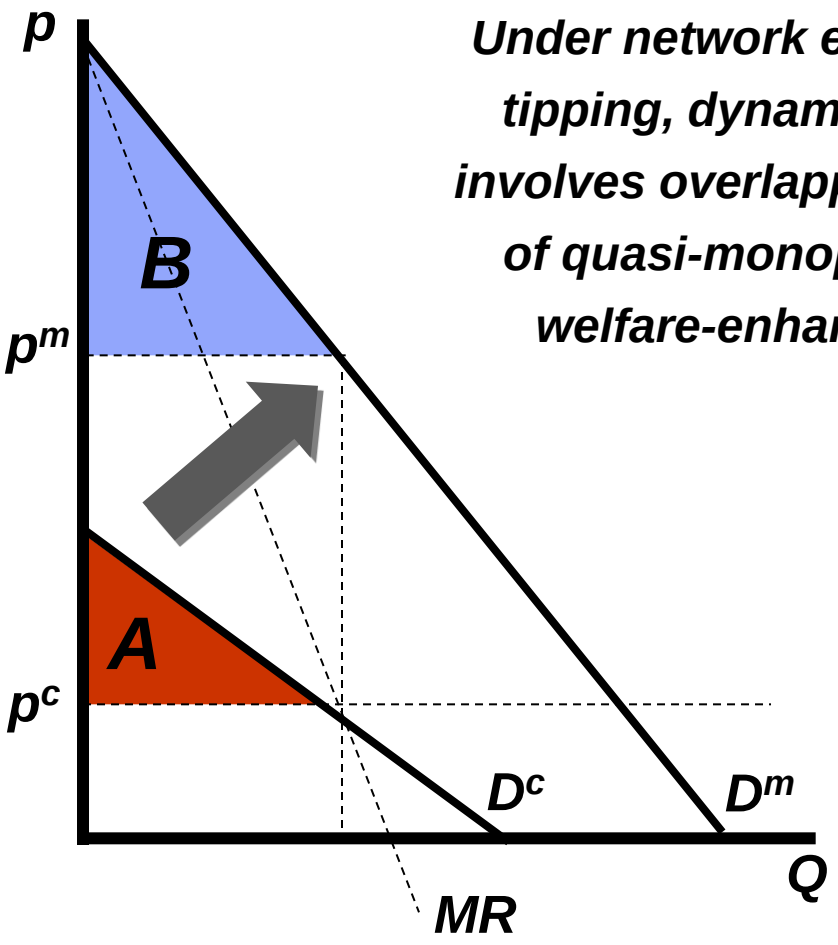
- **Direct network externalities**
  - ✓ The value of a network increases along with the number of users
  - ✓ **Metcalfe's law**: the value increases exponentially as the users grow linearly
  - ✓ ***Example***: telephone networks

- **Indirect network externalities**
  - ✓ The value of a platform increases along with the number of applications/services on the platform
  - ✓ ***Example:*** Video recorders, Game consoles

Network externalities

- **Consequences:**
  - ✓ one big network is worth more than two non-communicating networks
  - ✓ **Tipping**: markets naturally converge towards one single standard
  - ✓ **Competition for the market**: firms may compete aggressively to become the industry standard by charging very low prices.
  - ✓ Competition will be “for”, not “in” the market (winner-takes-all competition).
  - ✓ Standard-holders will have a competitive advantage, as barriers to entry are often quite high due to the need to reach the “critical size”

Competition “for” the market



Under network externalities and tipping, dynamic competition involves overlapping generations of quasi-monopolists. This is welfare-enhancing if B > A

Two-sided markets

- **A business is a two-sided platform if it has:**
  - ✓ two distinct sets of customers;
  - ✓ who need each other;
  - ✓ who can't get together easily on their own;
  - ✓ and for which a platform makes both sides better off by harnessing positive indirect network effects.

Evans (2004)

- Necessary and sufficient condition: the volume of transactions is sensitive to the distribution of total costs between the two sides

Rochet-Tirole (2004)

Two-sided markets

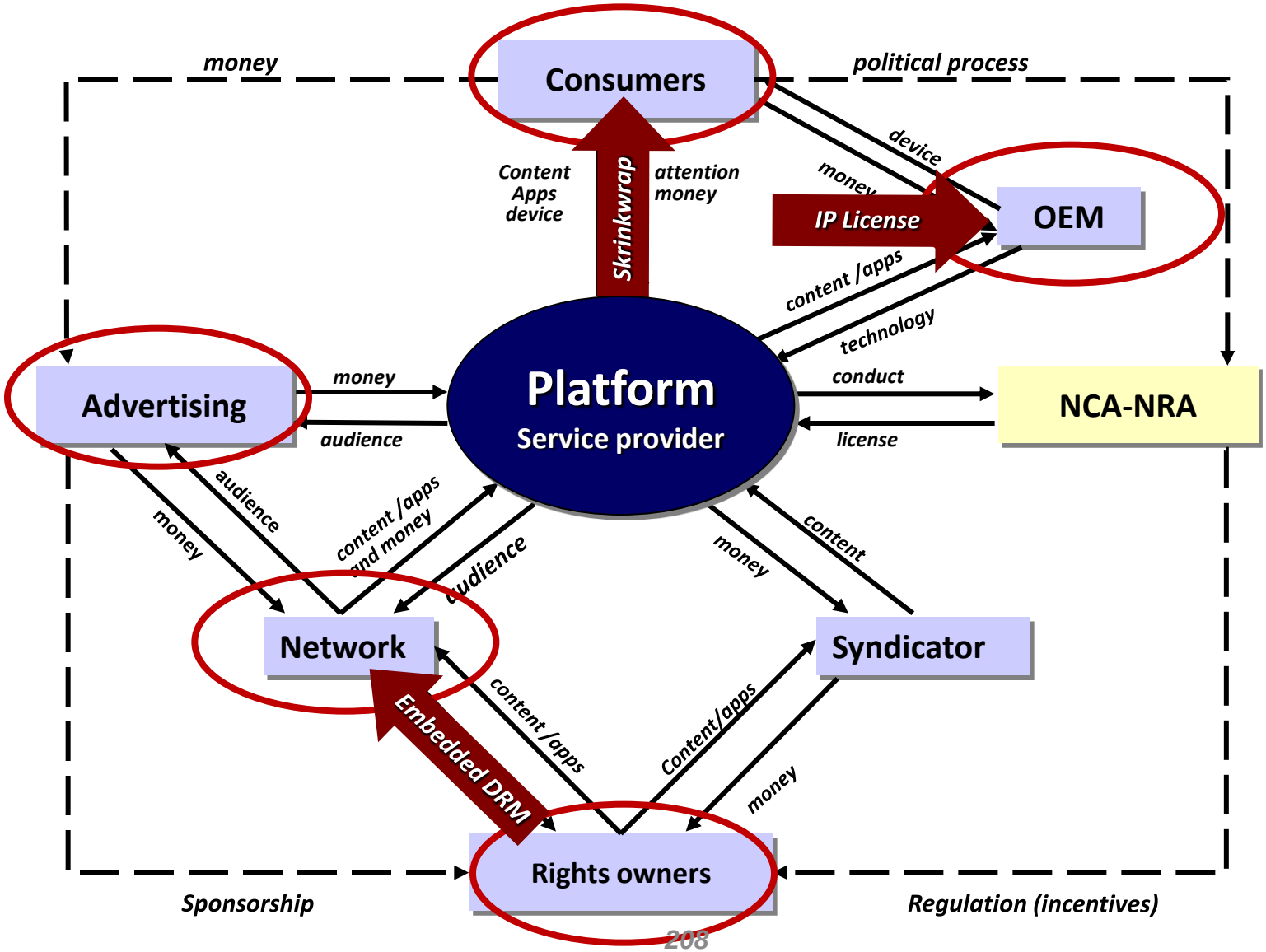
Multi-Sided Platform	Sides	Side that is "charged less" (at or below marginal cost)	Presence of Multihoming
On-line auctions	Buyer Seller	Buyer	Common Common
Newspapers and Magazines	Reader Advertiser	Reader	Common Common
Web Portals	Viewer Advertiser	Viewer	Common Common
Operating System	End User Developer	Developer	Uncommon Common
Video Game Console	Game Player Game Developer	Game Player	Uncommon Common
Mobile Phones	Subscriber Off-Network	Subscriber	Common Mixed

Evans (2004)

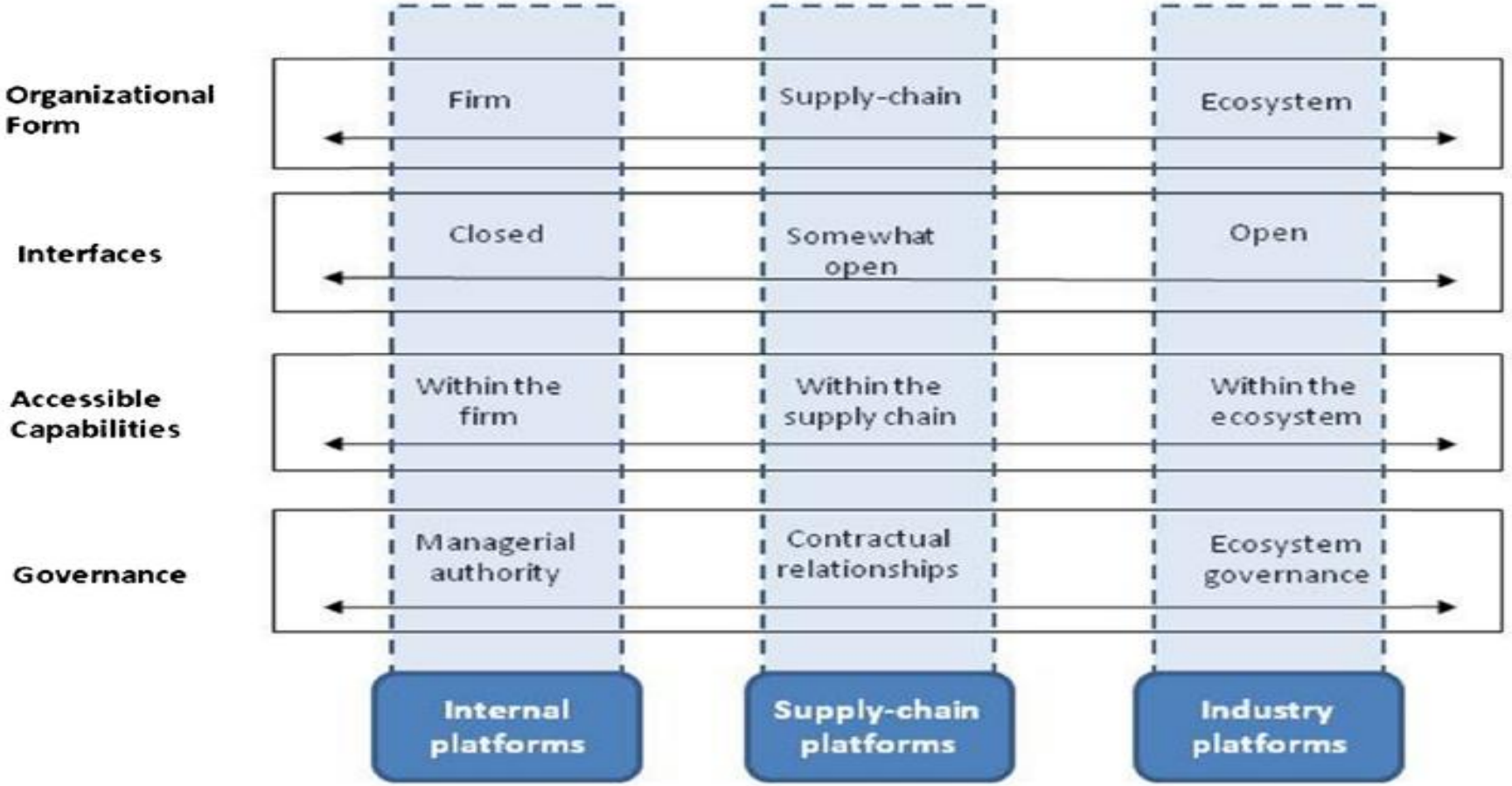
Two-sided markets

- **Chicken-egg problem**
  - ✓ Where to start? It depends on indirect network externalities.
- **Pricing**
  - ✓ Prices for a market side do not track marginal costs
  - ✓ increase in marginal cost on one side will ordinarily result in price increase for both sides
  - ✓ standard mark-up formulas do not apply
  - ✓ prices may be zero or negative
  - ✓ products may be given away
  - ✓ costs incurred for one side result in benefits for the other

Multi-sided markets

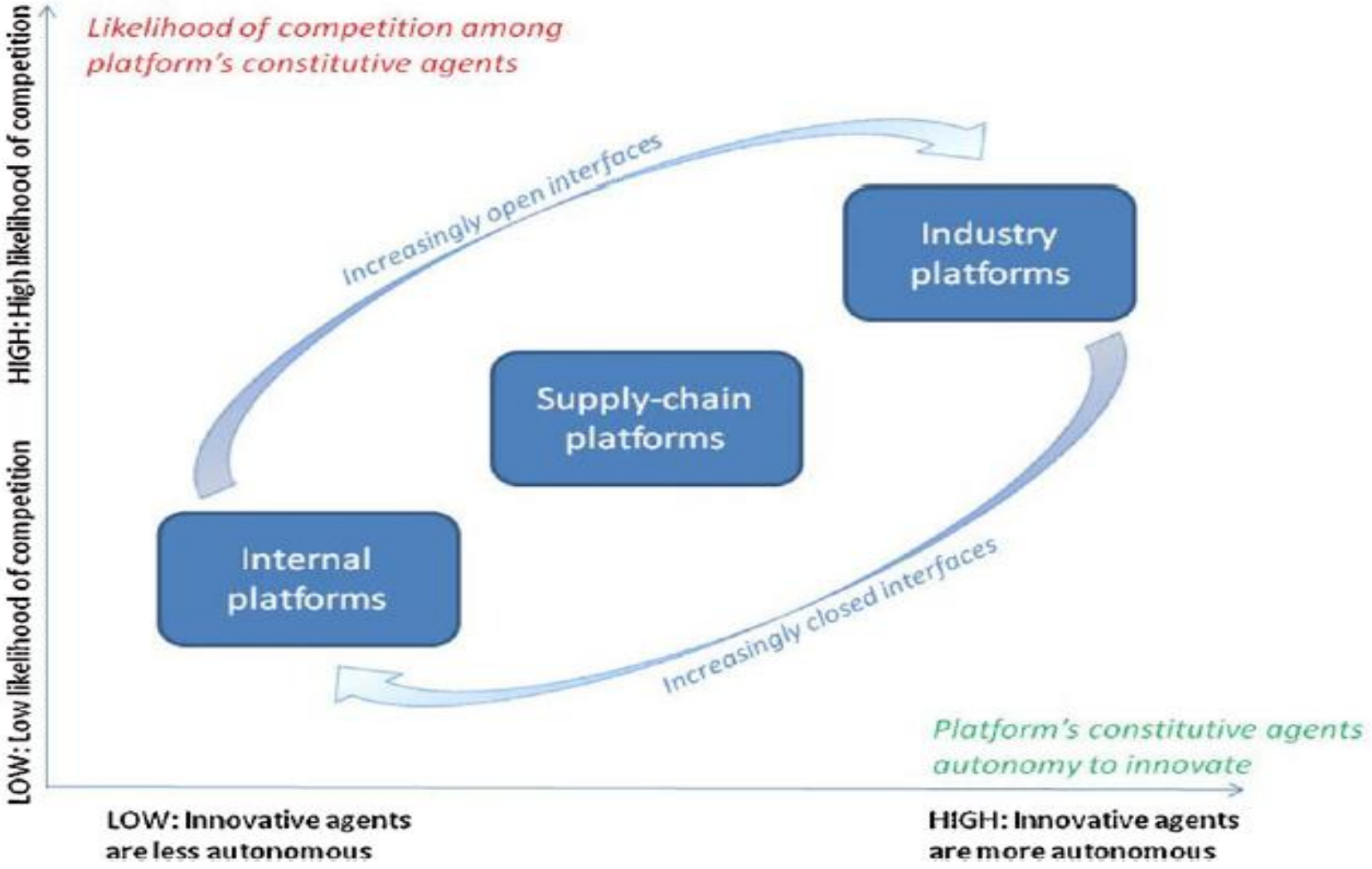


Platform economics



Source: Gawer (2015)

Platform economics



Source: Gawer (2015)

Session 6

Policy tensions for the age of algorithms, and consequences for neutrality, privacy, cybersecurity

Bangkok, 4 May 2016

Three quotes

"The crisis takes a much longer time coming than you think, and then it happens much faster than you would have thought"

"A wealth of information creates a poverty of attention"

"At the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted"

The beginning…

The Internet will become like a "celestial juke-box"

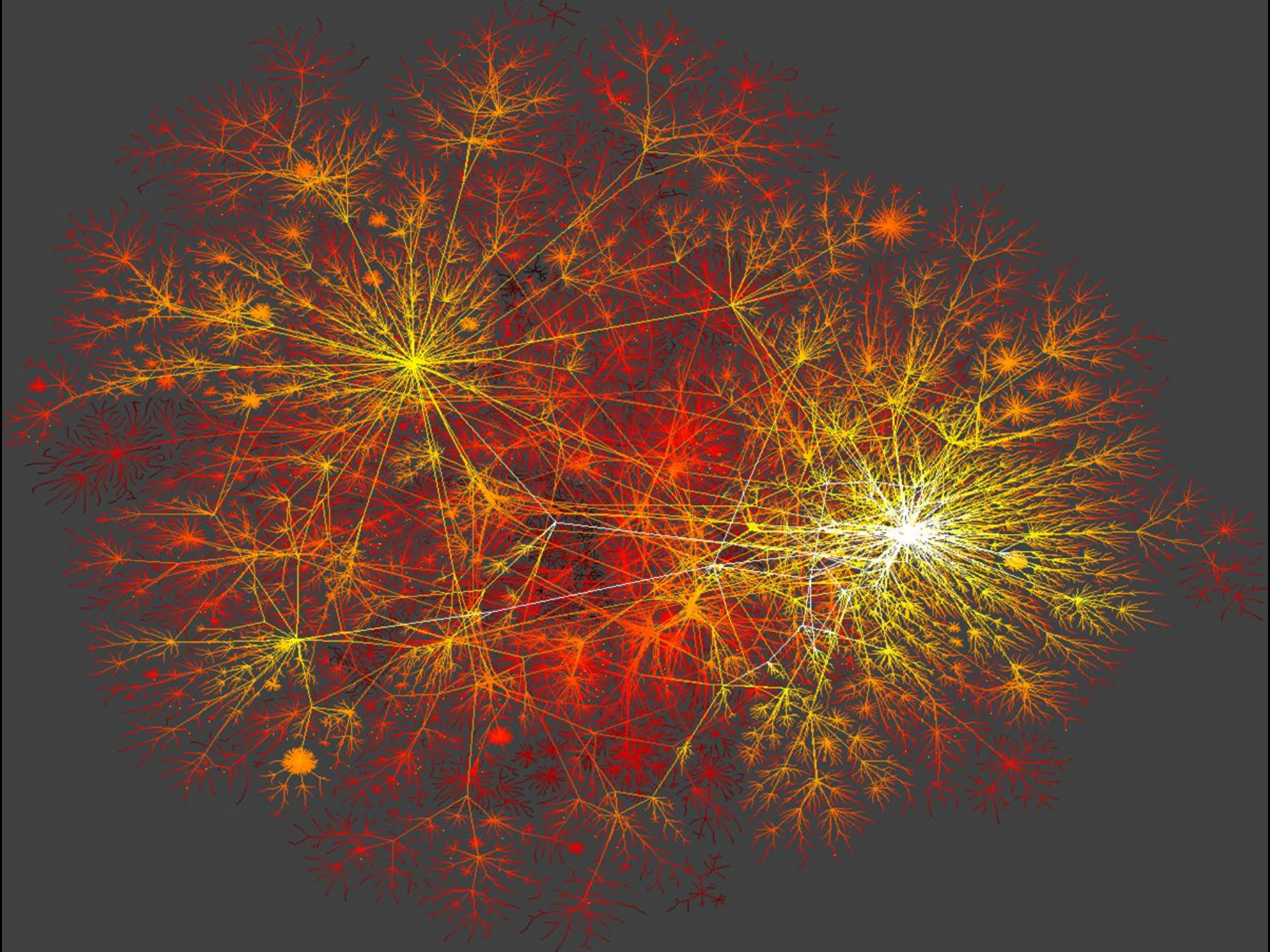
Paul Goldstein (1993)

"Copyright is dead"

John Perry Barlow (1994)

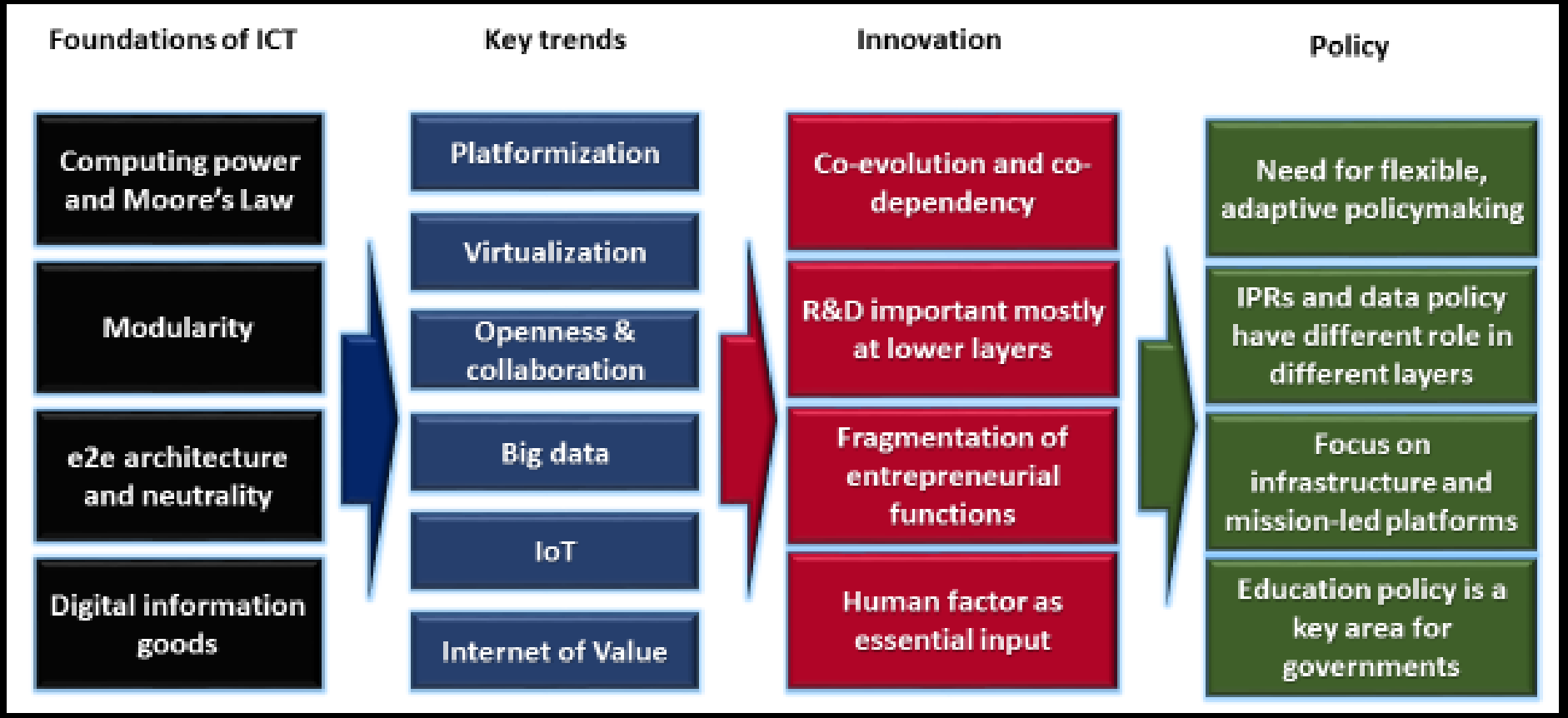
In cyberspace: code, not law, defines what's possible

Lawrence Lessig (from 1996 onwards)



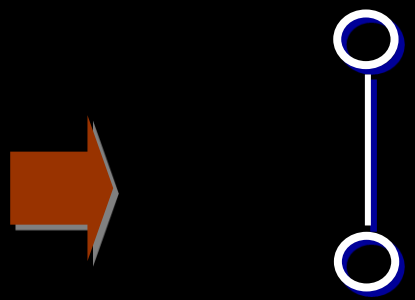
"On the Internet, nobody knows you're a dog."

From foundations to policies

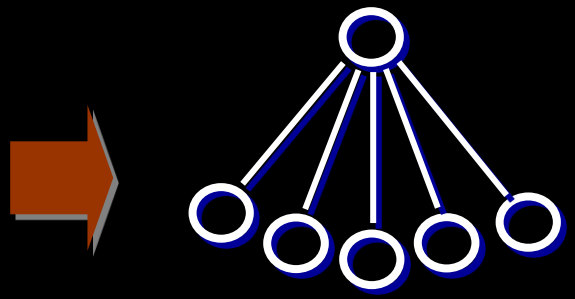


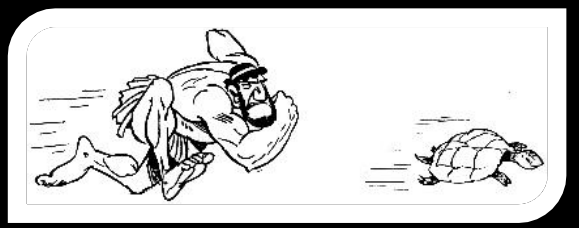
Achilles and the turtle

- *Mp3.com (2000)*
  - ***One-way downloads***
  - ***No sharing***
  - ***Space-shifting***
  - ***Not fault-tolerant***
  - ***Not extensible***
  - ***Not lawsuit-proof***



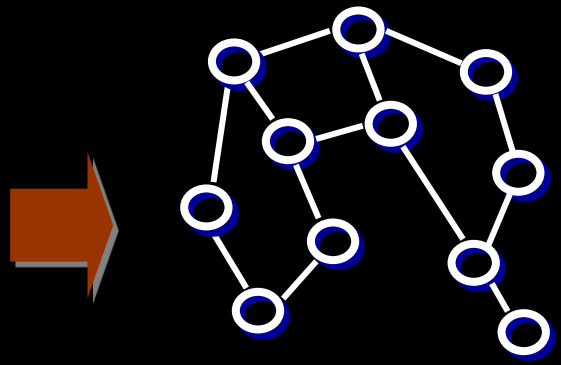
- *Napster (2000)*
  - ***Centralized***
  - ***Static***
  - ***Manageable***
  - ***Not extensible***
  - ***Not fault-tolerant***
  - ***Not lawsuit-proof***





Achilles and the turtle

- *Morpheus (2003)*
  - ***Decentralized***
  - ***Dynamic***
  - ***Difficult to manage***
  - ***Extensible***
  - ***Fault-tolerant***
  - ***Lawsuit-proof***



- *Grokster (2003)*
  - ***Decentralized***
  - ***Dynamic***
  - ***Manageable***
  - ***Extensible***
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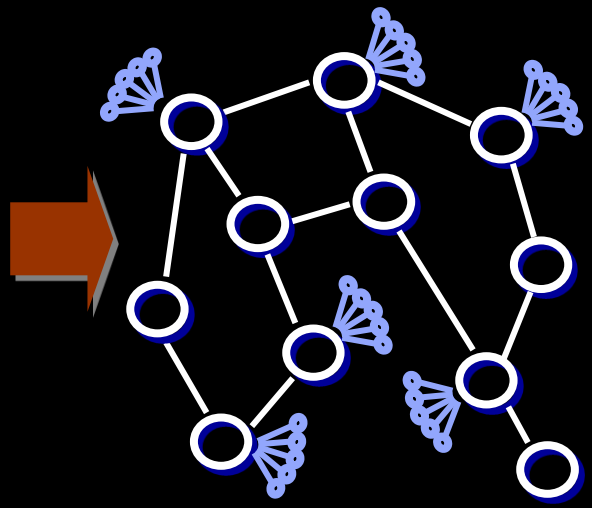
  - ***Lawsuit-proof***



Inducement theory

p2p boom!

2 Find MP3
ABC
Acquisition
Adagio
Amini p2p Software
aMule Project
ANts p2p
Anywhere Explorer
Apollon
Applejuice
Ares
Ares p2p
Arliweb Folders
AudioGalaxy Rhapsody
AudioGnome
Axbar
Azureus
BadBlue
BCDC++
BearShare

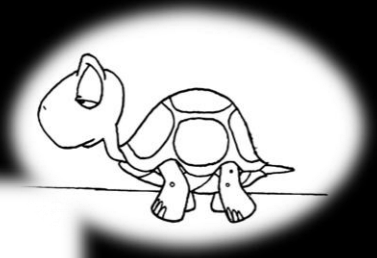
BitComet
BitComet Accelerator
BitLord
BitSpirit
BitTorrent
BitTorrent Absolute Downloader
BitTorrent Lite
Black Pirate FS
Blubster
BT2Net
Bt2Net Jet-speed Downloader
BTGetit
Carracho
Connect Storm
Crazaa
DC++
Deepnet Explorer
Diet K
Digital Media Server
DIYP2P / Paranoia
DriveHQ

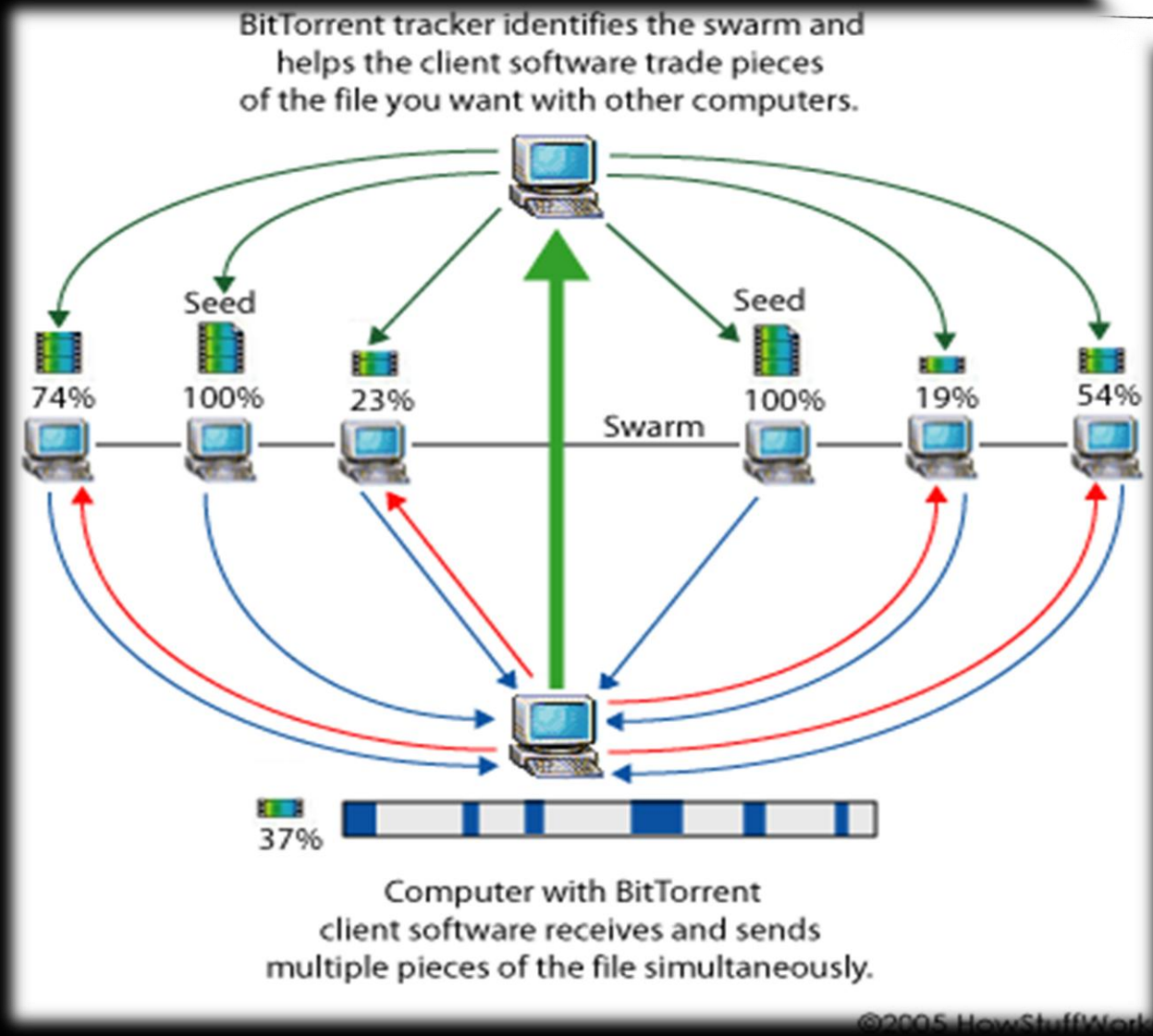
Easy File Sharing Web Server
eDonkey 2000
eDonkey Accelerator
eFileGo
Einstein
Emule
eMule Plus
eXeem
FilePipe
Filetopia
Freenet
Gnucleus
Grokster
Grouper
Haxial KDX
iMesh
iMesh Light
iMesh Revolution
InfocuSoft Photo Share
K-LiteGold
Kast
KaZaa
Kazaa All-in-One
Kazaa Lite Resurrection

KazaaHttp
Knutell
LimeWire
Lphant peer to peer
MagicVortex
MediaGrab!
Mercora IMRadio
Mextractor
MLdonkey
Morpheus
MP3-Wolf
Myster
Network Sunshine
Nodescan
Noxx
P2P ShareSpy
Peer2Mail
PeerFolders
PeerFTP
Personal File Server
Piolet
PixVillage
PruneBaby!
PySoulSeek
Qnext

Searchius
SendLink
Shareaza
ShareDirect
ShareGear
ShareIt
Soulseek
Streamjack Music
The Circle
Torrent Searcher
Torrentopia
TribalWeb
TrustyFiles
Web file manager
HTTP Commander
WinMP3Locator
WWW File Share Pro
XBT
Xolox
YaCy
ZipTorrent
Zultrax

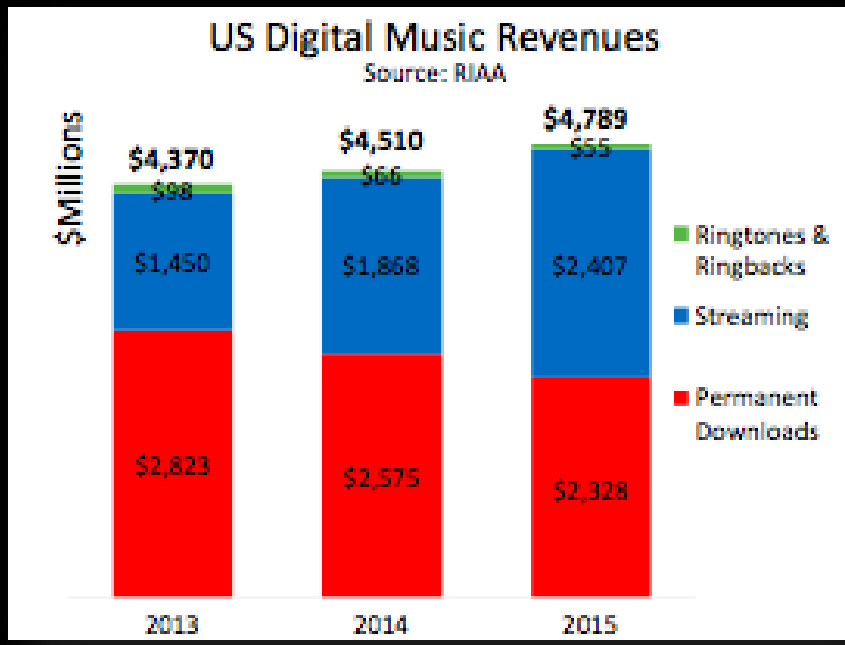
Technology wins again…





Only technology beats technology

- The platformization of the internet and the emergence of cloud-based streaming services is tilting the balance in favor of legal access
- In 2015, streaming revenues for the first time surpassed revenues from digital downloads (RIAA)



Online copyright infringement taught us a lesson:

by deferring decision-making to an algorithm, you can escape liability…

… and governments have no easy counter-strategy

15 years of Google

1995: **Larry Page and Sergey Brin meet at Stanford.**

1996: Page and Brin, now Stanford computer science grad students, begin collaborating on a search engine called **BackRub**, which operates on Stanford servers.

1997: **Name changed to Google,** a play on the word "googol," the term for the number one followed by 100 zeros.

Sept. 4, 1998: Sets up shop in California garage and hires one employee.

1999: Outgrows two offices and goes from eight to 40 employees.

2000: Eric Schmidt (above right) named CEO; Google becomes world's largest search engine.

2001: **Image search** launched.

2002: **Google Labs** and **Google News** launched.

2003: Acquires Pyra Labs (creators of **Blogger**).

2004: Moves to campus-like "Googleplex" with over 800 employees; **Gmail** launched; Company goes public at $85 per share.

2005: **Google Maps and Google Earth released**; **Google Reader** introduced at Web 2.0 conference.

2006: **Google calendar** launched; Announces acquisition of **YouTube**

2007: Gmail no longer invite-only; **Street View** debuts in five U.S. Cities; Android OS announced

2008: **Chrome** released

2009: Announced development of Google Chrome OS

2010: Nexus One, Google's flagship smartphone, introduced; First playable doodle (for Pac-Man's 30th birthday); Google Instant begins (search results as you type); Google's self-driving cars log more than 225,000 km

2011: Page becomes CEO; **Google Wallet** (tap phone to pay) available on Sprint Nexus S; **Google+** open to sign-ups after going through 90-day field trial

2012: **Google Play** and **Google Drive** launched; **Project Glass** unveiled; Acquired Motorola Mobility; Samsung Chromebook (laptop) released

2013: Chromebook Pixel (laptop) announced

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

26 M 1998 · 1 B 2000 · 3 B 2001 · 8 B 2004 · 17 B 2009 · 29 B 2010 · 46 B 2011 · 50 B 2012

50 As of April 2013, the number of countries on Street View

1.5 B Approximate number of indexed images

1,000 Number of "Google doodles" that have been posted since the first one in 1998

The verb "google" was added to the Merriam Webster and Oxford English Dictionary in 2006

DID YOU KNOW?
The "I'm Feeling Lucky" button takes you directly to the first search result, completely bypassing the results page.

Approximate number of Google's indexed pages

Google *1998: Brin's original computerized logo*

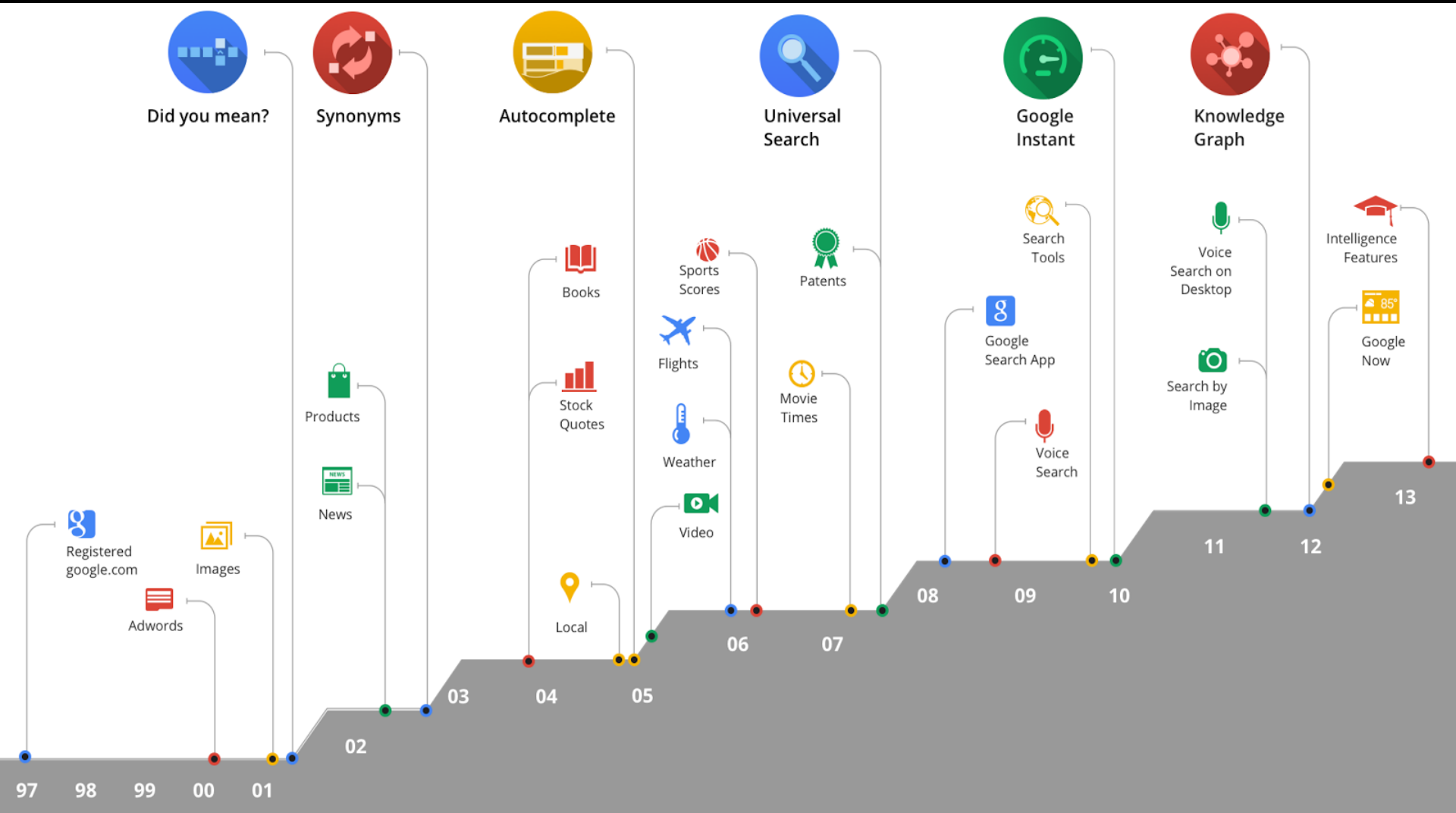
Google! *August 1998 – May 1999: Designed by Ruth Kedar*

Google *May 1999 – May 2010*

Sources: Google; Wikipedia; statisticbrain.com

SUSAN BATSFORD, GRAPHICS EDITOR, TWITTER @SBATS1; INFOGRAPHIC BY MEGAN DINNER/QMI AGENCY

Improving artificial intelligence



Google’s gradual non-neutrality

GOOGLE ALGORITHM	PANDA	PENGUIN	HUMMINGBIRD
SEARCH	CONTENT	BACK-LINKS	ANSWERS, NOT KEYWORDS
WIN	Well-written content Informative content Low bounce rate	Natural back-links Natural anchor text profile	Longer content Wider range of words Content written to deliver direct answers
LOSE	Thin content Duplicate content Auto-generate content Content farm	Over optimised content Keywords stuffing Low quality back-links Links schemes	Thin content keyword based Keyword based optimisation

Source: Consider This UK

Google's gradual non-neutrality

- **Panda/Farmer — February 23, 2011**
  - A major algorithm update hit sites hard, affecting up to 12% of search results (a number that came directly from Google). Panda seemed to crack down on thin content, content farms, sites with high ad-to-content ratios, and a number of other quality issues.
- **Panda 2.0 (#2) — April 11, 2011**
  - Google rolled out the Panda update to all English queries worldwide (not limited to English-speaking countries). New signals were also integrated, including data about sites users blocked via the SERPs directly or the Chrome browser.
- **Panda 3.1 (#9) — November 18, 2011**
  - After Panda 2.5, Google entered a period of "Panda Flux" where updates started to happen more frequently and were relatively minor. Some industry analysts called the 11/18 update Panda 3.1, even though there was no official 3.0.
- **Penguin — April 24, 2012**
  - After weeks of speculation about an "Over-optimization penalty", Google finally rolled out the "Webspam Update", which was soon after dubbed "Penguin." Penguin adjusted a number of spam factors, including keyword stuffing, and impacted an estimated 3.1% of English queries.
- **Penguin 2.0 (#4) — May 22, 2013**
  - After months of speculation, the 4th Penguin update (dubbed "2.0" by Google) arrived with only moderate impact. The exact nature of the changes were unclear, but some evidence suggested that Penguin 2.0 was more finely targeted to the page level.
- **Hummingbird — August 20, 2013**
  - Announced on September 26th, Google suggested that the "Hummingbird" update rolled out about a month earlier. Hummingbird has been compared to Caffeine, and seems to be a core algorithm update that may power changes to semantic search and the Knowledge Graph for months to come.
- **Panda 4.0 (#26) — May 19, 2014**
  - Google confirmed a major Panda update that likely included both an algorithm update and a data refresh. Officially, about 7.5% of English-language queries were affected.
- **Penguin 3.0 — October 17, 2014**
  - More than a year after the previous Penguin update (2.1), Google launched a Penguin refresh. This update appeared to be smaller than expected (<1% of US/English queries affected) and was probably data-only (not a new Penguin algorithm).

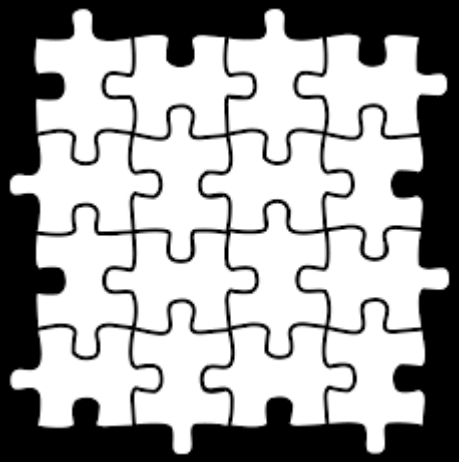
500 updates every year!!

Source: Moz, Google Algorithm Change History

What did we learn?

- Search engines make decisions!
- They cannot be neutral, otherwise they would be useless! And they would be made non-neutral by their rivals
- They cannot be held responsible, unless one proves that a human mind intentionally programmed them to cause damage
- Once again, no suitable remedy has been identified by any government

The puzzle

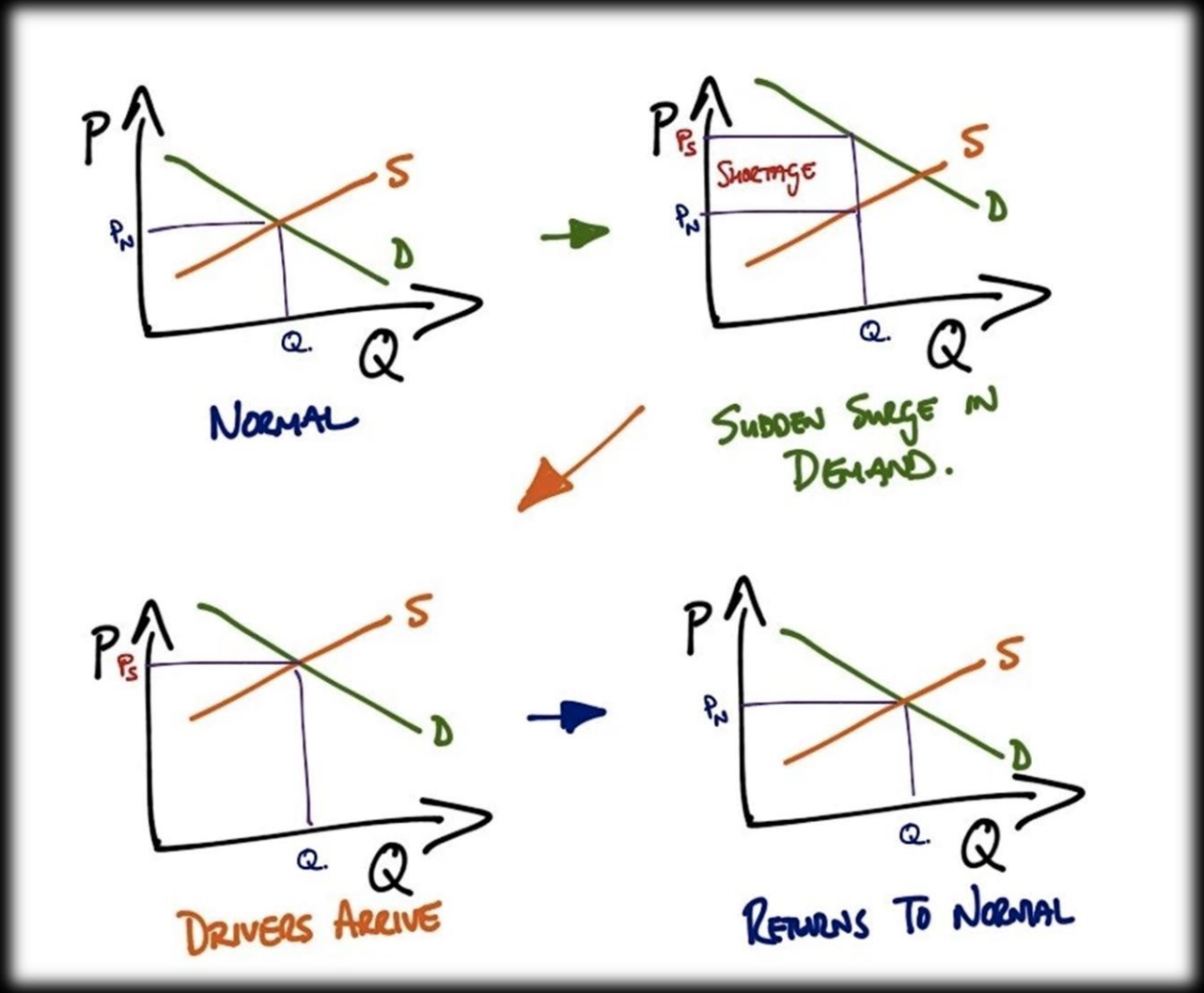


- Algorithm is (trade) secret
- Algorithm is used to discriminate
- Public authority imposes a change in the algorithm to enforce legal rules
- The algorithm is changed twice a day..
- .. And public authority cannot observe changes.

The FTC (2013)

"Google adopted the design changes … to improve the quality of its search results, and any negative impact on actual or potential competitors was incidental to that purpose"

Next case: Uber price-surge



Next case: Facebook Messenger bots

"We think you should be able to message a business like you would message a friend."

- Mark Zuckerberg

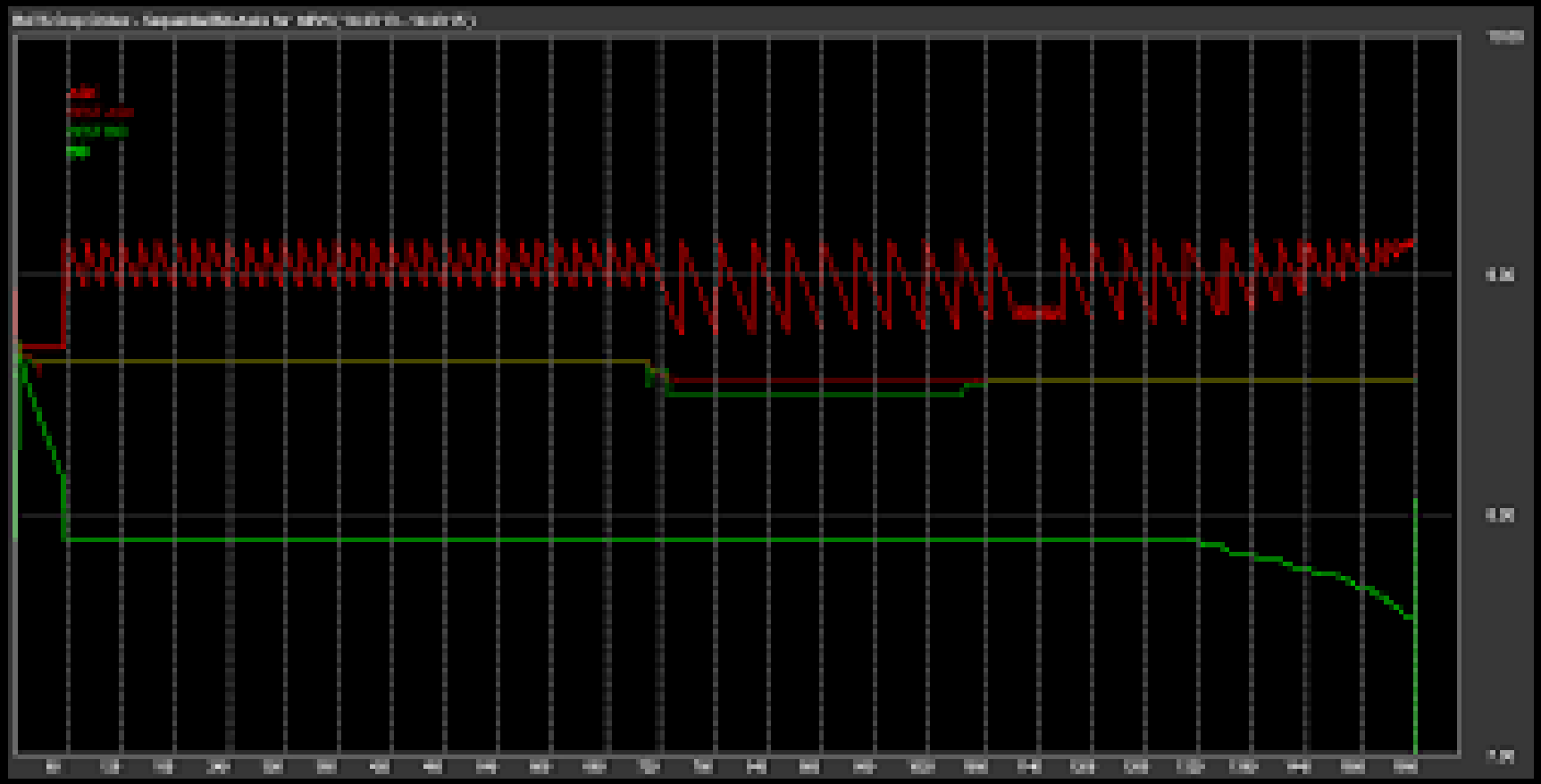
When are algorithm (programmers) responsible?

How do we deal with algorithm interaction and conflict?

Easy cases…

Building the un-hackable?

Writing the unreadable: Algo trading

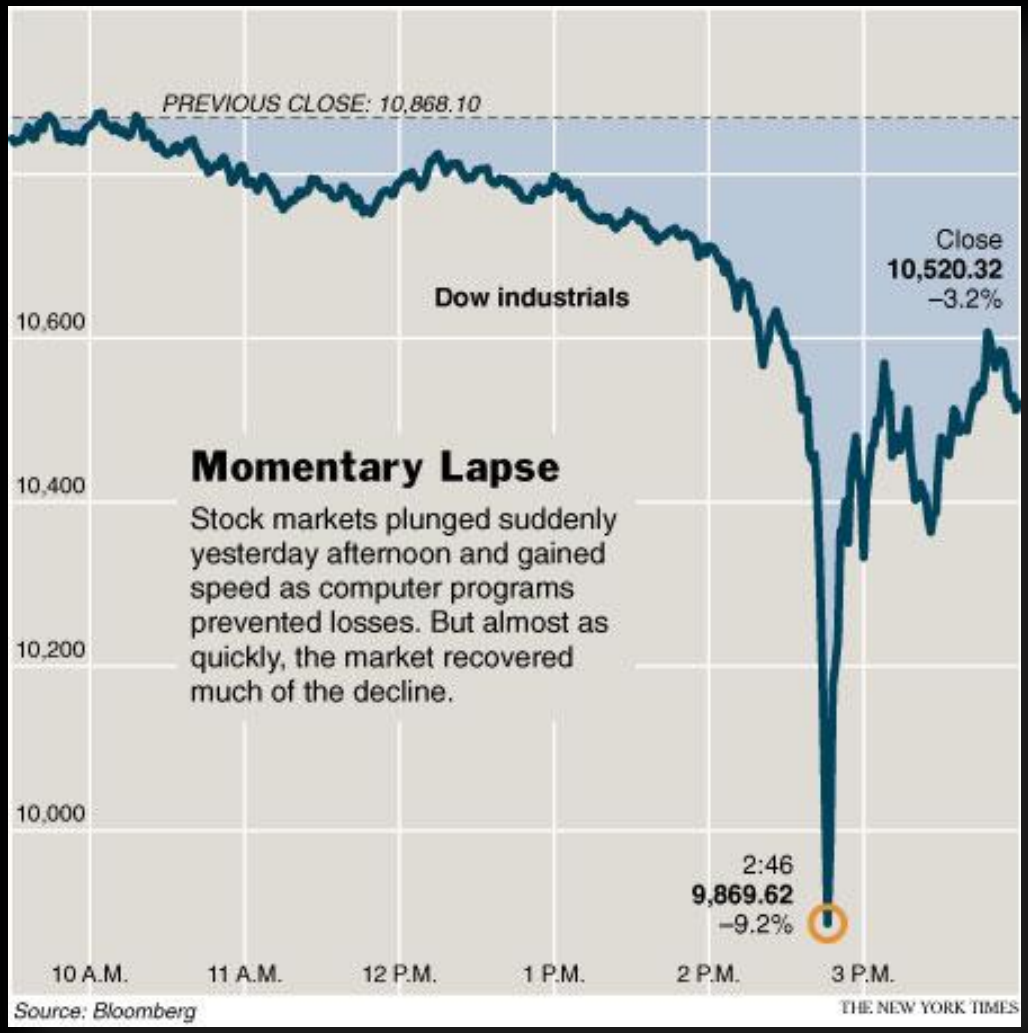


Writing the unreadable: Algo trading

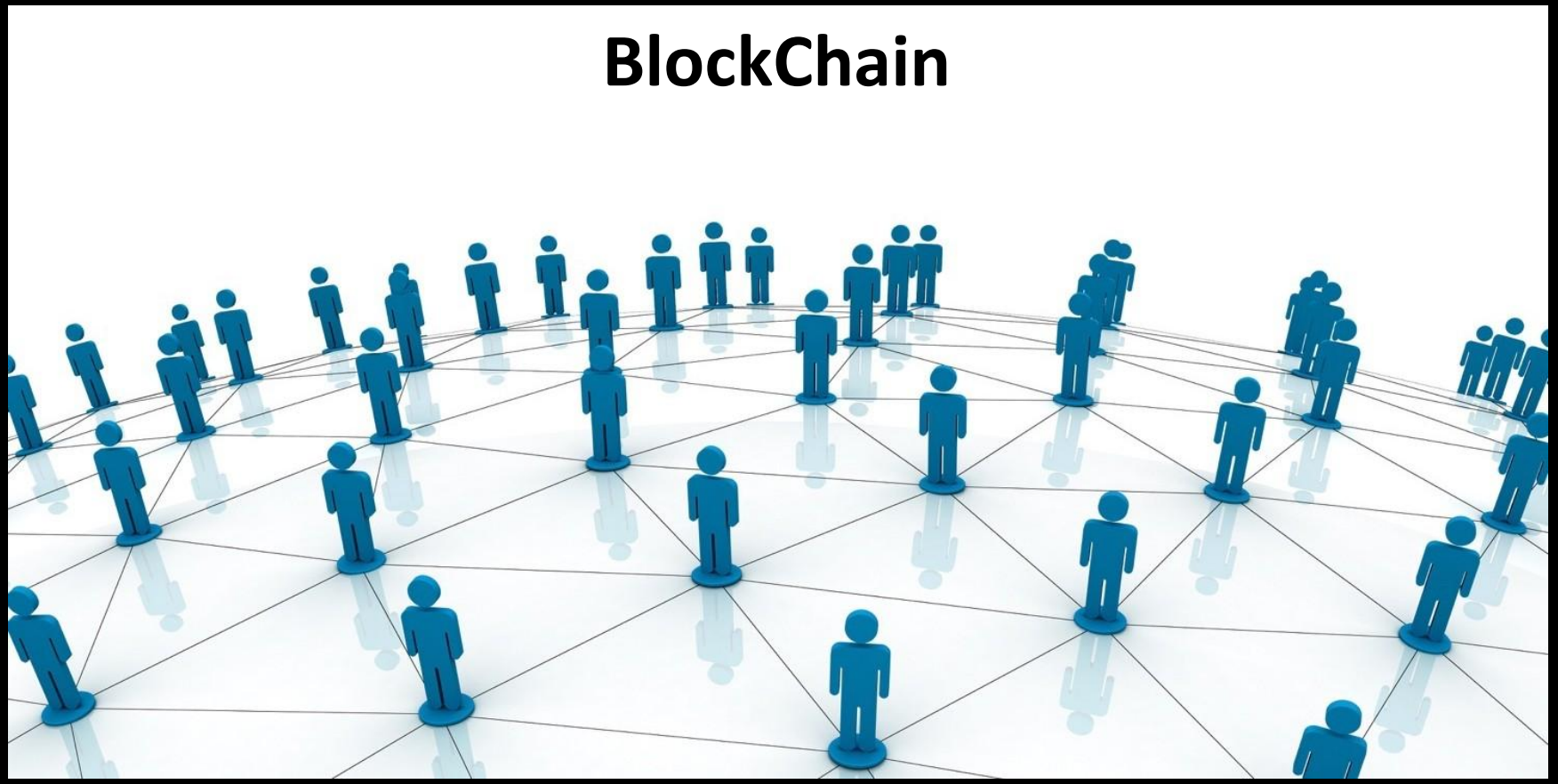
“Flash crash of 2.45”

- 9.2%!

Who is responsible?

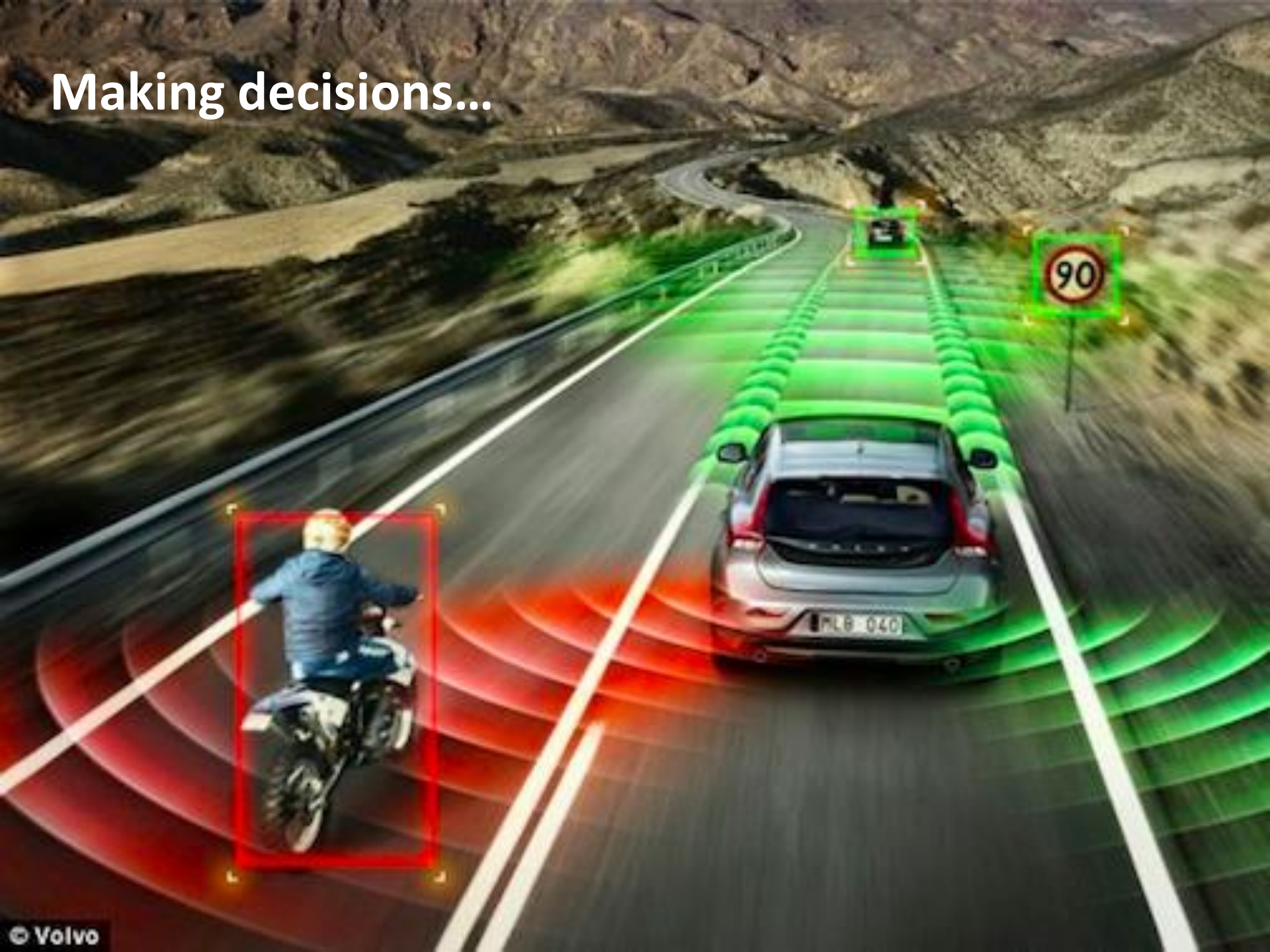


Collective (ir)responsibility?



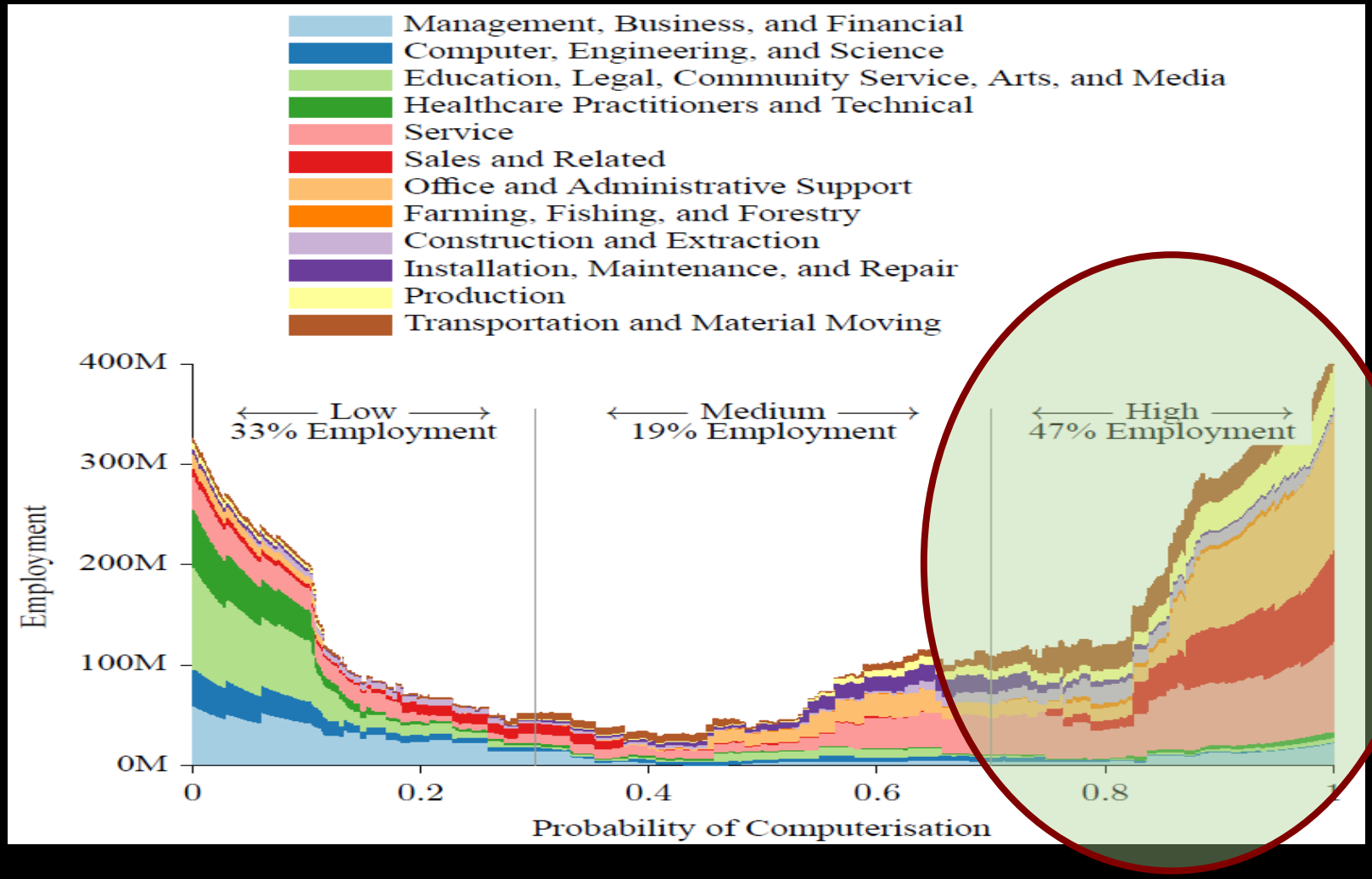
Making decisions…

Making decisions…



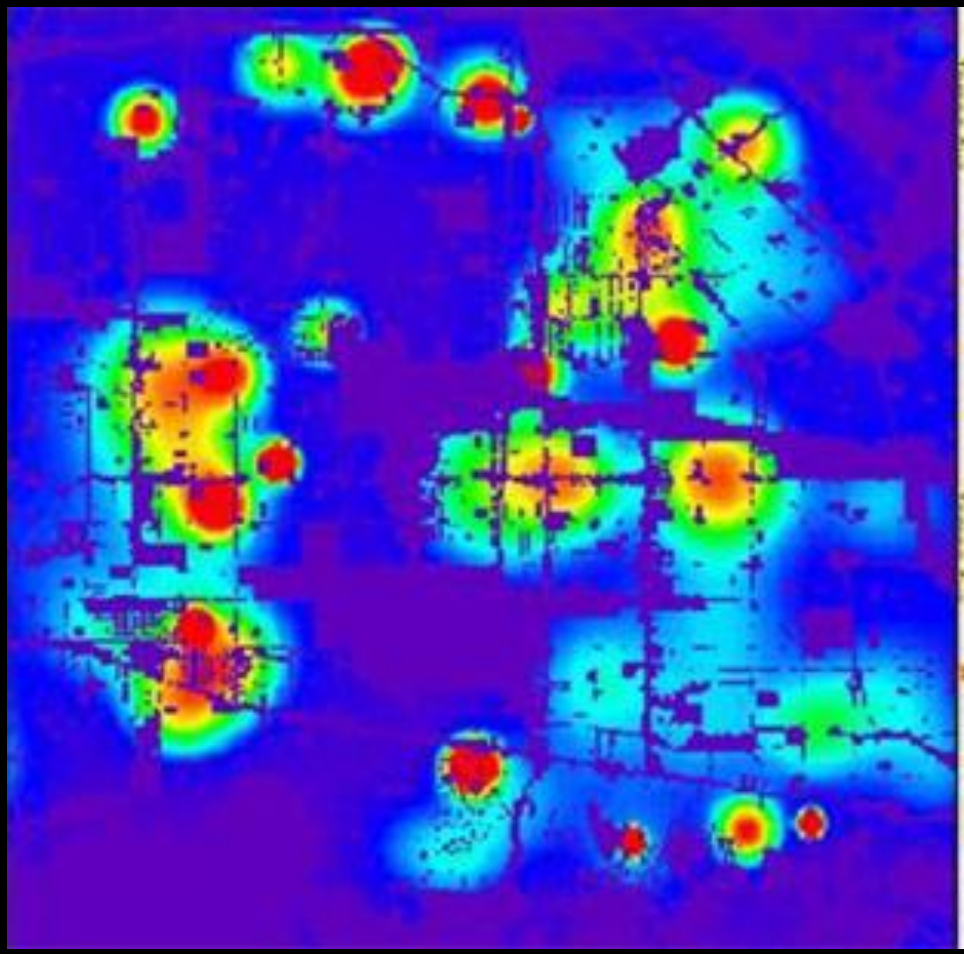
Making decisions…

Replacing humans…

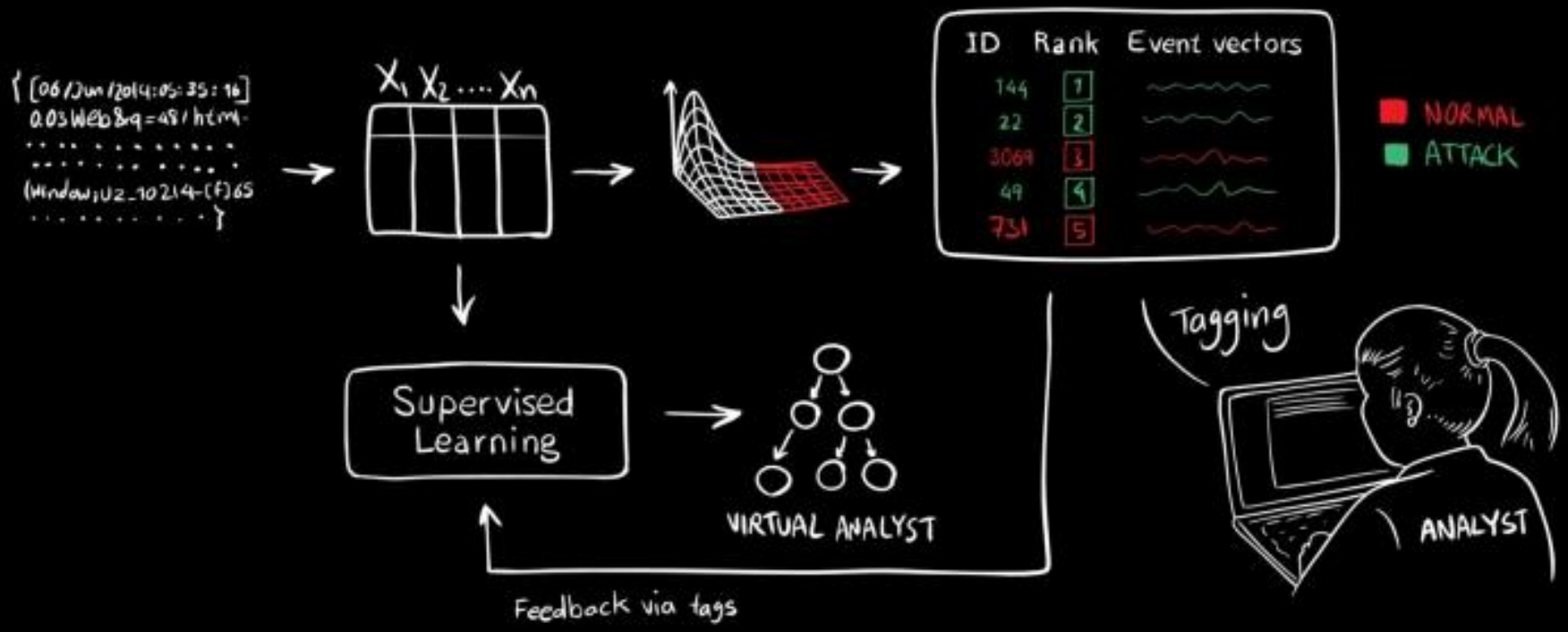


Source: Osborne e Frey (2013). The Future Of Employment: How Susceptible Are Jobs To Computerisation?, University of Oxford, September 17, 2013

Forecasting and nowcasting: Predpol

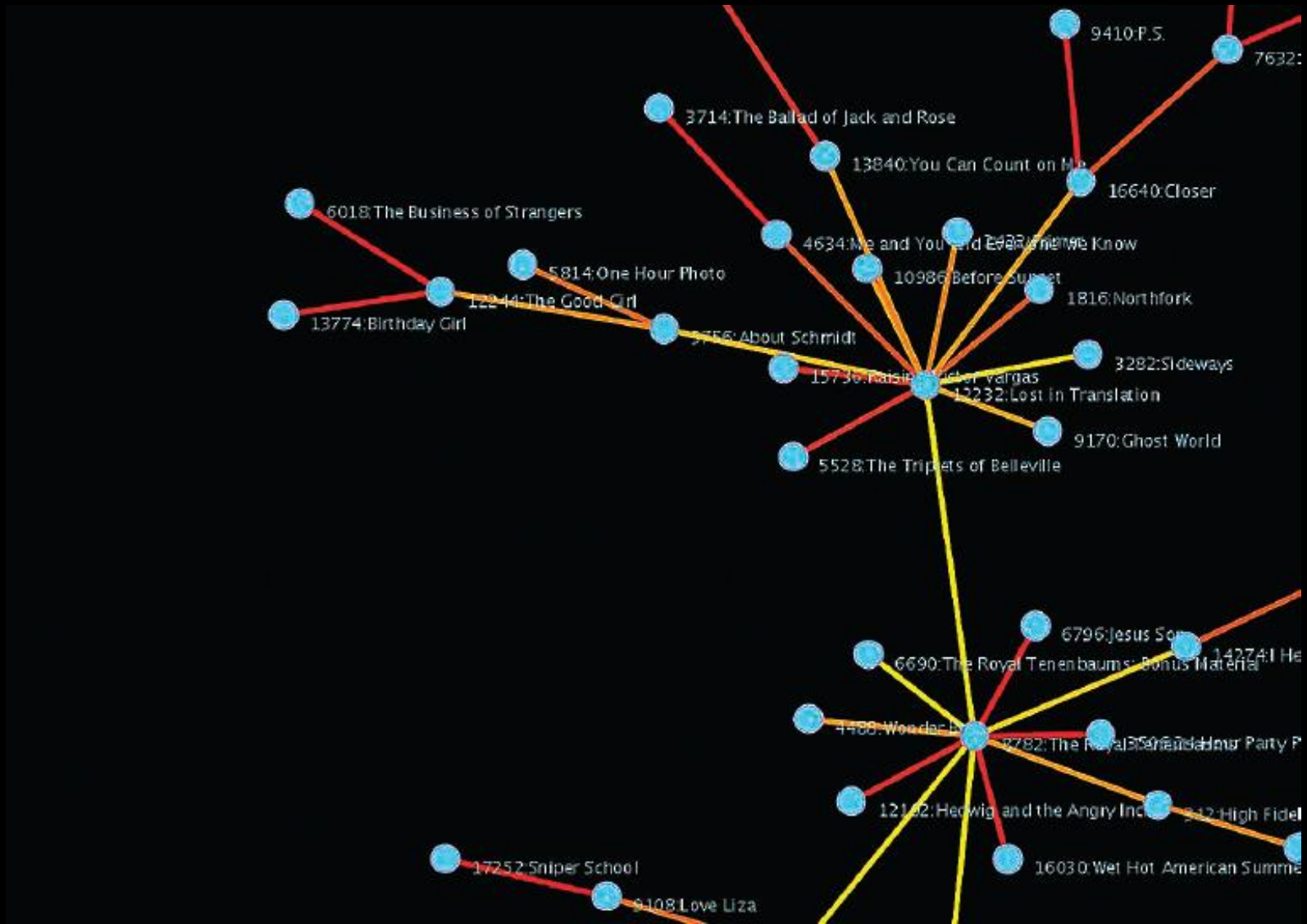


Forecasting and nowcasting: AI²



Seeing what we don’t…

Knowing what we'll like



Building the “digital panopticon”

(12) **United States Patent**
Lunt

(10) **Patent No.: US 9,100,400 B2**
(45) **Date of Patent: *Aug. 4, 2015**

(54) **AUTHORIZATION AND AUTHENTICATION BASED ON AN INDIVIDUAL'S SOCIAL NETWORK**

(75) Inventor: **Christopher Lunt**, Mountain View, CA (US)

(73) Assignee: **Facebook, Inc.**, Menlo Park, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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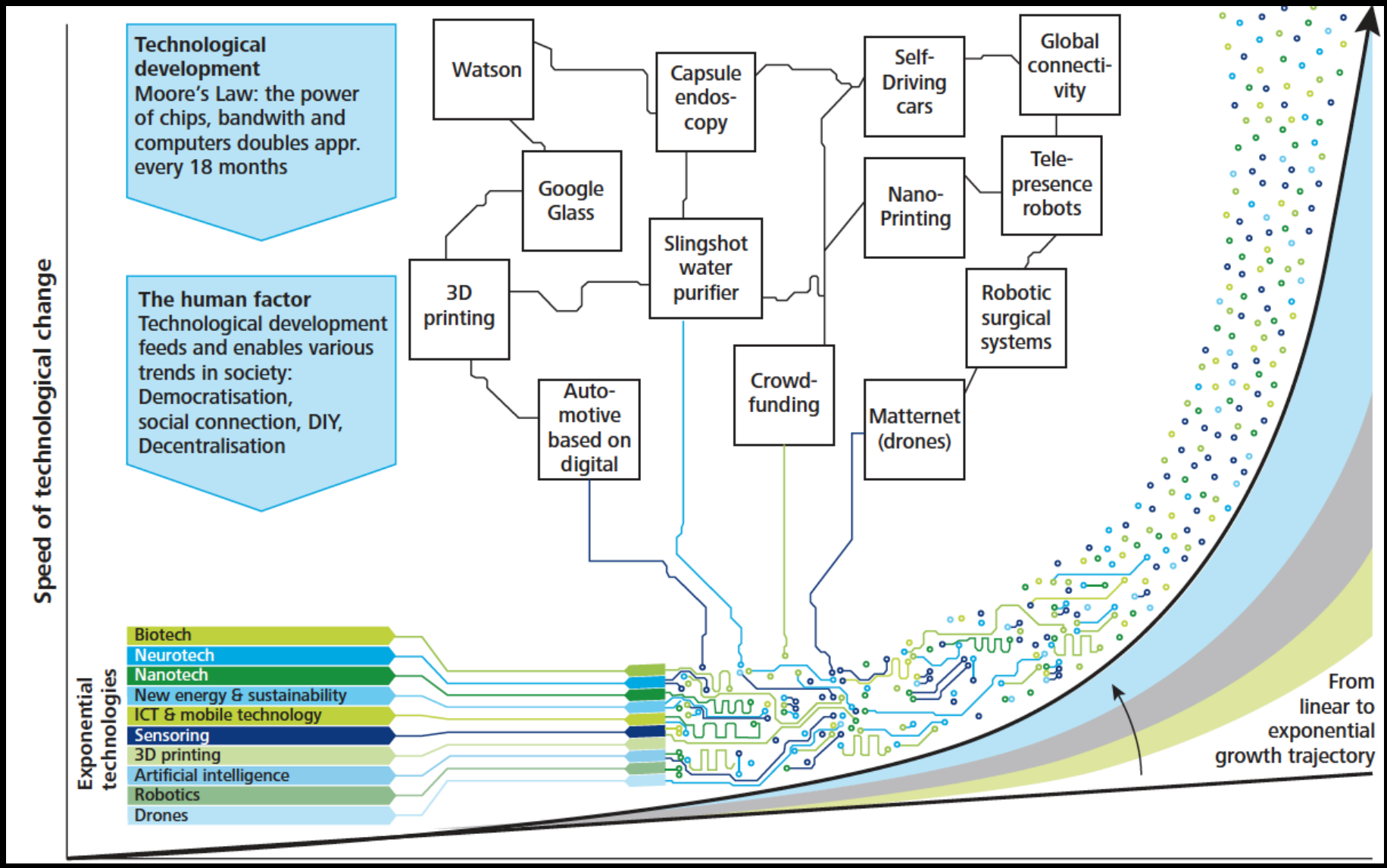
6,073,105	A	6/2000	Sutcliffe
6,073,138	A	6/2000	de l'Etraz
6,175,831	B1	1/2001	Weinrich

The end of the beginning?

An exponential growth path



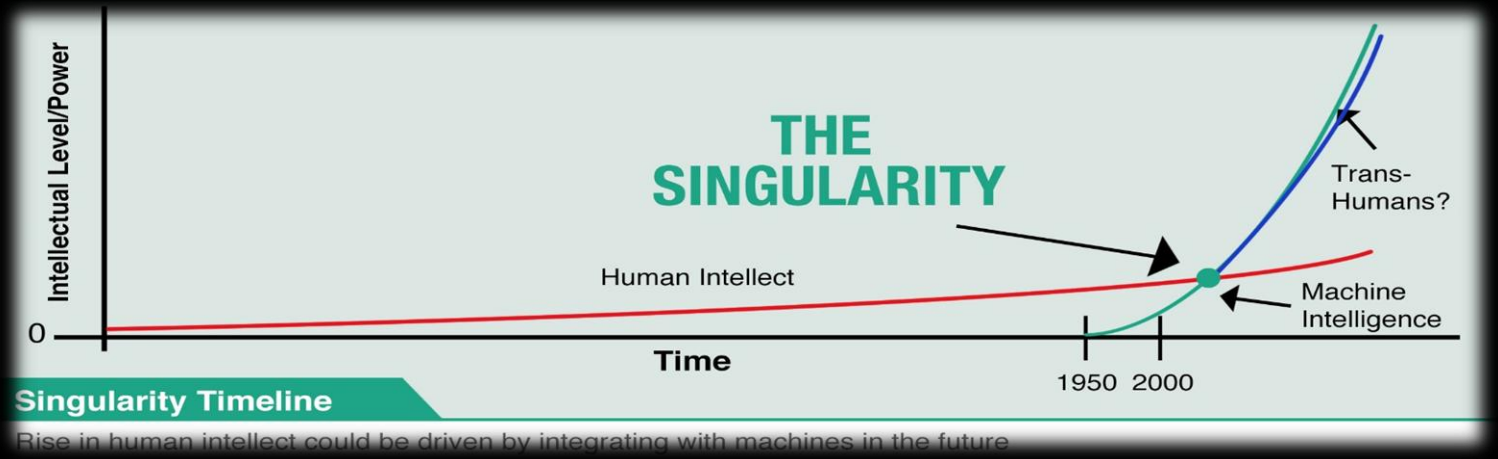
Source: Deloitte

AlphaGO


ALPHAGO
00:12:09
Google DeepMind
Challenge Match
LEE SEDOL
00:34:31

The path to singularity

- ***Intelligent, self-governed objects that communicate with each other: what happens when algorithms start learning from each other and from their mistakes?***
- ***Time is ripe to discuss their «rules of engagement»***
- ***Singularity or human-machine integration?***



Source: McCarren (2014)

Implications: privacy, cybersecurity, CIIP

Facing the challenge

- You can regulate technology only with technology. And you are likely to lose
- Online platforms and algorithms cannot be neutral: they should be held responsible, but at what cost?
- Privacy laws will be shaken in the years to come: selective, multi-layer access to data is the most likely solution
- Open, collective intelligence must come with forms of responsibility: but we don’t know how to achieve this result

The privacy challenge (1)

- **Countries have enacted very different privacy laws over the past years, based on their legal traditions and their approach to Internet policy**
  - **In the US, privacy is essentially a property right, tradable for other benefits**
    - This enables data-driven business models and big data
    - Emphasis is mostly on Government intrusion into the private sphere (Fourth Amendment)
    - Statutory law largely follows this approach (ECPA Title II, PATRIOT Act, FREEDOM Act)
    - FTC adopts a “case by case” approach to enforcing various statutes that protect user privacy

The privacy challenge (2)

- **Countries have enacted very different privacy laws over the past years, based on their legal traditions and their approach to Internet policy**
  - **In the EU, privacy is a fundamental right**
    - New General Data Protection Regulation (GDPR) creates a horizontal, comprehensive framework for data protection
    - GDPR imposes “informed consent” for treatment of personal data, in many cases difficult to interpret for companies
    - Companies that treat personal data must appoint Data Protection Officers
    - Very difficult to launch data-driven business in Europe

The privacy challenge (3)

- **The CJEU *Costeja* decision (May 2014):**
  - **Search engines are data controllers, and as such are responsible for the content they point to**
  - **Even if the server if physically located outside Europe, EU law applies anyway if the search engine has a branch or subsidiary actively operating in Europe**
  - **Individuals have the to ask the removal of content that relates to them if the information at hand is inadequate, inaccurate or excessive, subject to a balancing test with other fundamental rights (to be performed directly by the search engine)**

The challenges of the cloud

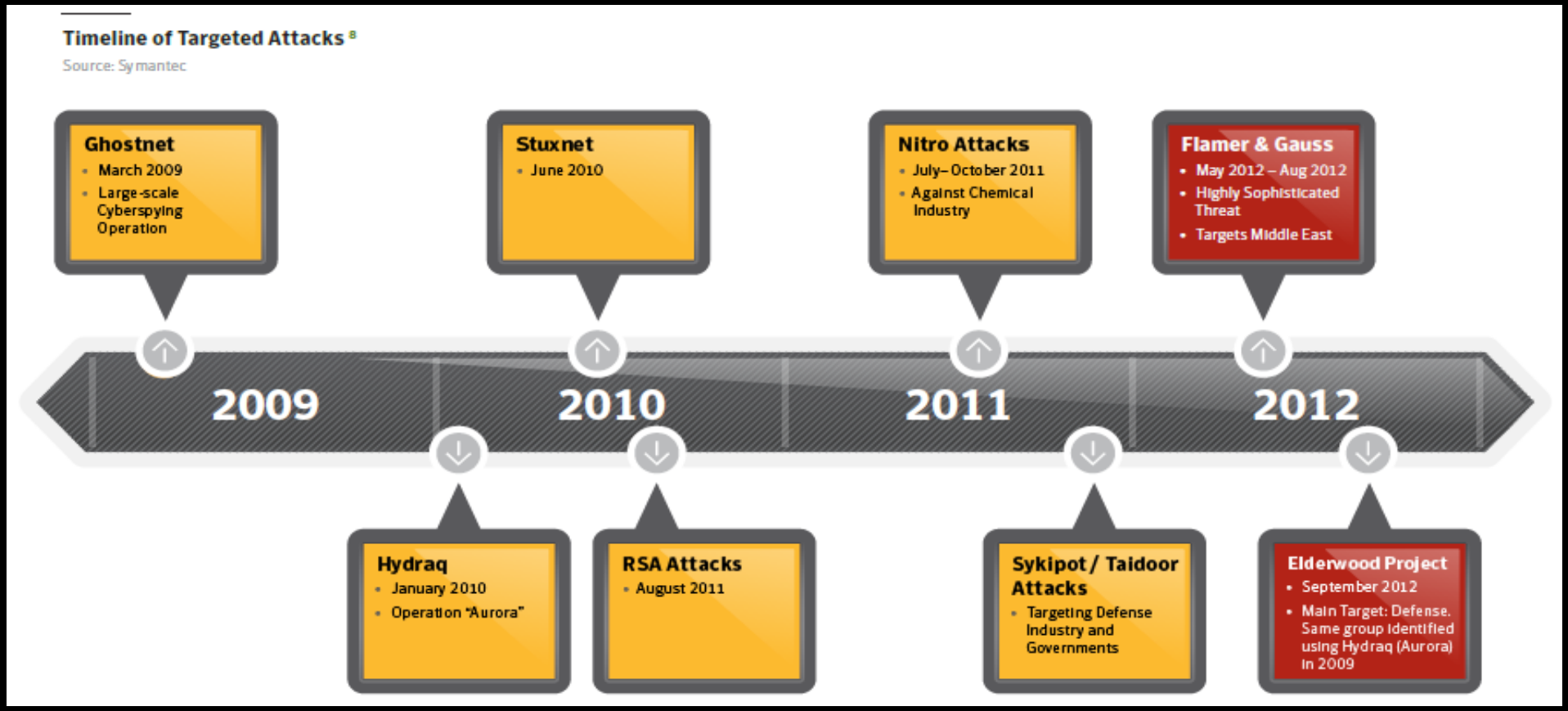
- Possible lack of control:
  - Lack of interoperability (vendor lock-in)
  - Lack of integrity
  - Lack of confidentiality
  - Lack of intervenability
  - Lack of isolation
- Lack of transparency
  - Especially in cases of chains of processors and controllers, and in cases in which data are processsed in mutiple geographic locations

Cybersecurity: towards a whole of government policy

Why CIP and CIIP have become (or should increasingly become) dominant policies

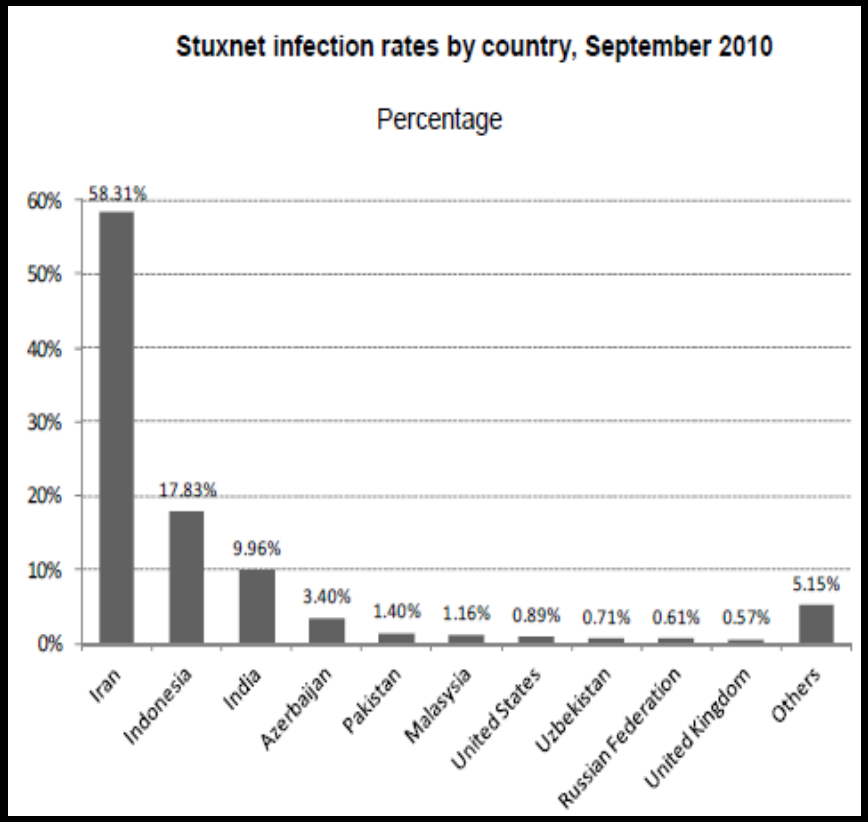
- **Increased infrastructure convergence** (e.g. Smart grids)
- **Increased need for infrastructure upgrade**
- **Need for redundancy and flexibility** (e.g. Deepwater Horizon had no "plan B" ready)
- **Increased unpredictability of attacks** (attack has an advantage over defence)
- **Need to enhance security against:**
  - Accidents
  - Errors
  - Cyber-attacks
- **Difficult to communicate CIP/CIIP policy to citizens**

Targeted attacks (2009-2012)



Targeted attacks: Stuxnet

- Allegedly developed by Israel with US support to hobble Iranian facilities (SCADA developed by Siemens)
- 10,000 estimated person/days, 6-9 months, 5-10 developers
- Development costs: $3 million
- Damaged also India, Indonesia etc.
- At Sept 2010, 100,000 infected hosts according to Symantec



Source: Falliere, Murch and Chien 2011

Targeted attacks: post-Stuxnet

- **Flame (2011):** attacks computers running Windows 7 and XP, mostly in the Middle East. It replicates itself to other computer systems and networks over LAN or USB, records audio using your drivers, takes screenshots, monitors keyboard activity and network traffic. Looks out for Skype and uses Bluetooth to steal data. Has infected over 1,200 machines.
- **Gauss (2012):** a "nation-state sponsored cyber-espionage toolkit" (Kaspersky) designed to steal passwords and banking data from individuals in the Middle East – particularly Lebanon.
- **DuQu (2012):** looks for info to attack industrial control systems and reports the sensitive data back to the mother ships. Captures keystrokes and computer system and network information.

Targeted attacks: Duqu 2.0

The 2014/2015 Duqu 2.0 is a greatly enhanced version of the 2011 Duqu malware discovered by [7]CrySyS Lab. It includes many new ideas from modern malware, such as Regin, but also lateral movement strategies and harvesting capabilities which surpasses commonly seen malware from other APT attacks.

Side by side:

	2011 Duqu	2014/2015 Duqu 2.0
Number of victims:	<50 (estimated)	<100 (estimated)
Persistence mechanism:	Yes	No
Loader:	SYS driver	MSI file
Zero-days used:	Yes	Yes
Main storage:	PNF (custom) files	MSI files
C&C mechanism:	HTTP/HTTPS, network pipes	HTTP/HTTPS, network pipes
Known plugins:	6	>100

There are many similarities in the code that leads us to conclusion that Duqu 2.0 was built on top of the original source code of Duqu. Those interested can read below for a technical description of these similarities.

The age of risk: not just cyber-warfare!

- **Natural disasters are a major cause of outages**
- **Errors and unintentional security incidents a major cause**
- **Intentional cyberattacks have various forms and targets**
  - Malware (Viruses, worms, trojans, etc.)
  - DDoS
  - Unauthorized access
  - Advanced Persistent Threats
  - Phishing
- **Increased evidence of cyberattacks that target financial services (WSJ, July 2013) and healthcare**

How the Carbanak cybergang stole $1bn

A targeted attack on a bank

1. Infection

Carbanak backdoor sent as an attachment

Bank employee

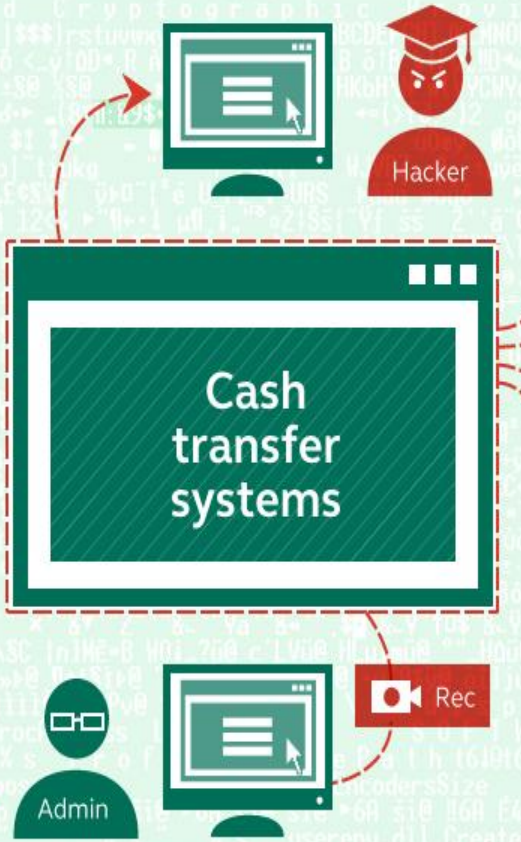
Emails with exploits

Credentials stolen

100s of machines infected
in search of the admin PC

2. Harvesting Intelligence

Intercepting the clerks' screens



3. Mimicking the staff

How the money was stolen

Online-banking
Money was transferred to fraudsters' accounts

E-payment systems
Money was transferred to banks in China and the US

Inflating account balances
The extra funds were pocketed via a fraudulent transaction

Controlling ATMs
Orders to dispense cash at a pre-determined time

GREAT KASPERSKY lab

Healthcare Global Threats

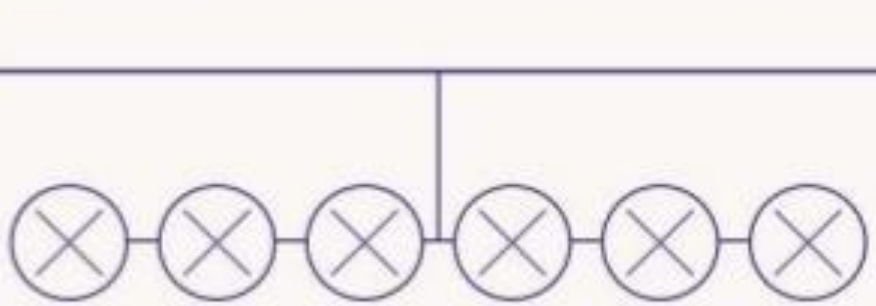
Worldwide,

40%

of health care organisations reported a cyber-attack in 2013 – double that reported in 2009.

Between 2011 and 2014 the NHS suffered over

7,000 breaches of data



that's 6

data breaches every day

Delivering the benefits of digital healthcare report , February 2016

Cybersecurity: towards a new generation of threats and responses

New kids in town…

- **“Every minute, we are seeing about half a million attack attempts that are happening in cyber space”**

  Derek Manky, Fortinet global security strategist, 2015

- **New techniques**
  - **Headless worms**
  - **Machine-to-machine attacks**
  - **“Drive-by” attacks**
  - **Jailbreaking**
  - **Ghostware**
  - **Blastware**
  - **Two-faced malware**

New trends

- Increased artificial intelligence on both sides. Algorithm chasing algorithms?
- Structural advantage of attack over defense. A PredPol for cyberattacks?
- Increasingly impossible for governments to prevent attacks alone (even with AI)
- Role of government confined to education, regulation, facilitation of information exchange between private players

New threats

- Privacy Threats
- Availability and Integrity Threats
- Threats from Software-Controlled Systems
- Threats from Interconnected Systems
- Threats from Automatic Algorithms
- Threats from Autonomous Systems
- Other Threats of New Technologies
- Catastrophic Risk
- Cyberwar

Source: Schneier (2016)

Shaping CIIP Policy: Problems

- 85% private and 15% public (estimated)
- Unbounded
- Networked
- Complex
- Human
- Vulnerable

The economics of CIIP: failures

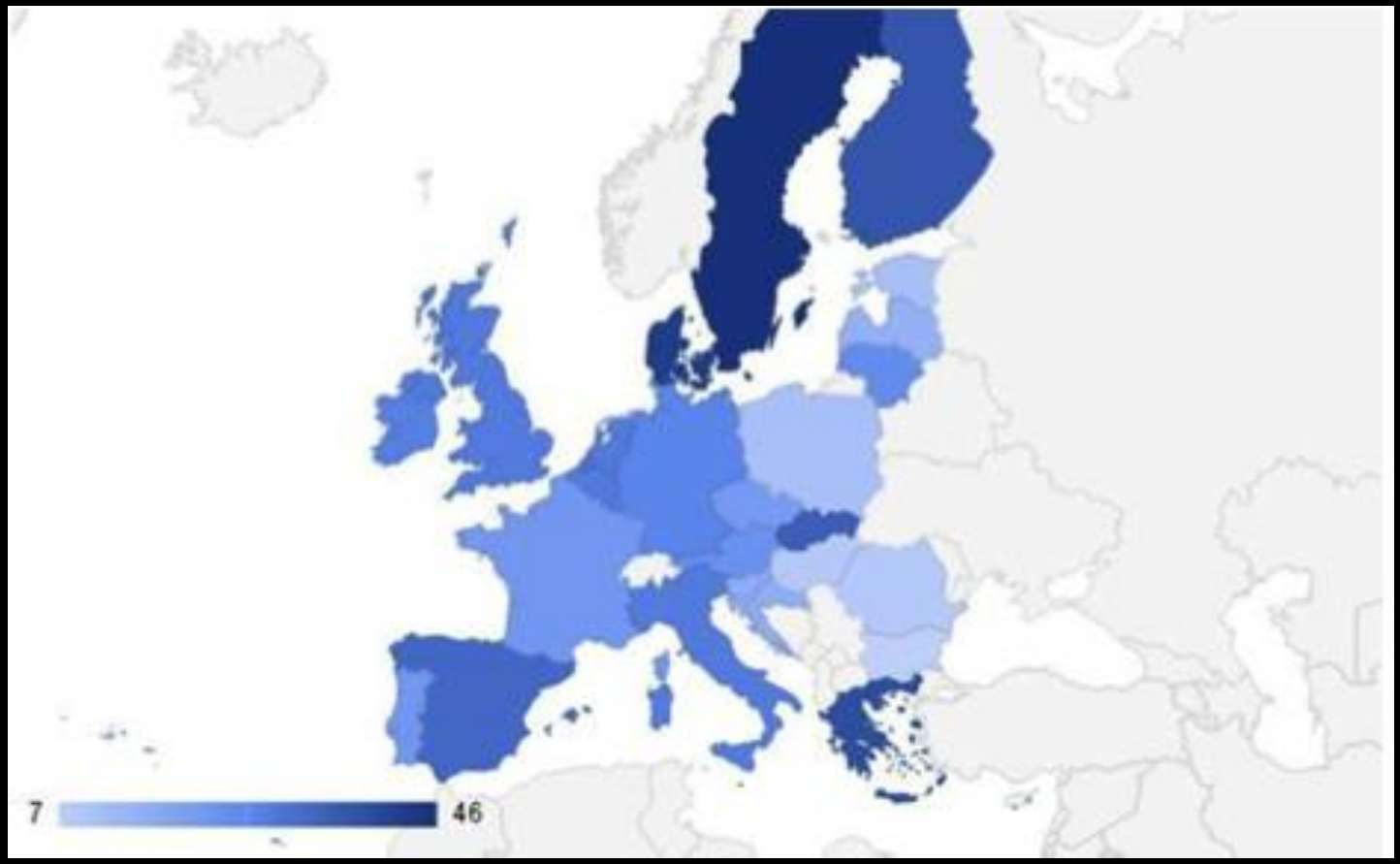
- Widespread externalities
- Principal-agent problems
- Behavioural biases
- Collective action problems
- Government failures
- Policy trade-offs

CIIP: main actors

- Government
- Specialized Response Teams (CSIRT/CERT)
- Analysis, communication and reporting centers (ISACs/WARPs)
- SCADA Systems
- Private sector
- Users!

Level of preparedness (excl. Financial)

Companies with more than 10 employees that reported having a formally defined ICT security policy in 2012



Source: Eurostat

The EU policy on cybersecurity and CIIP

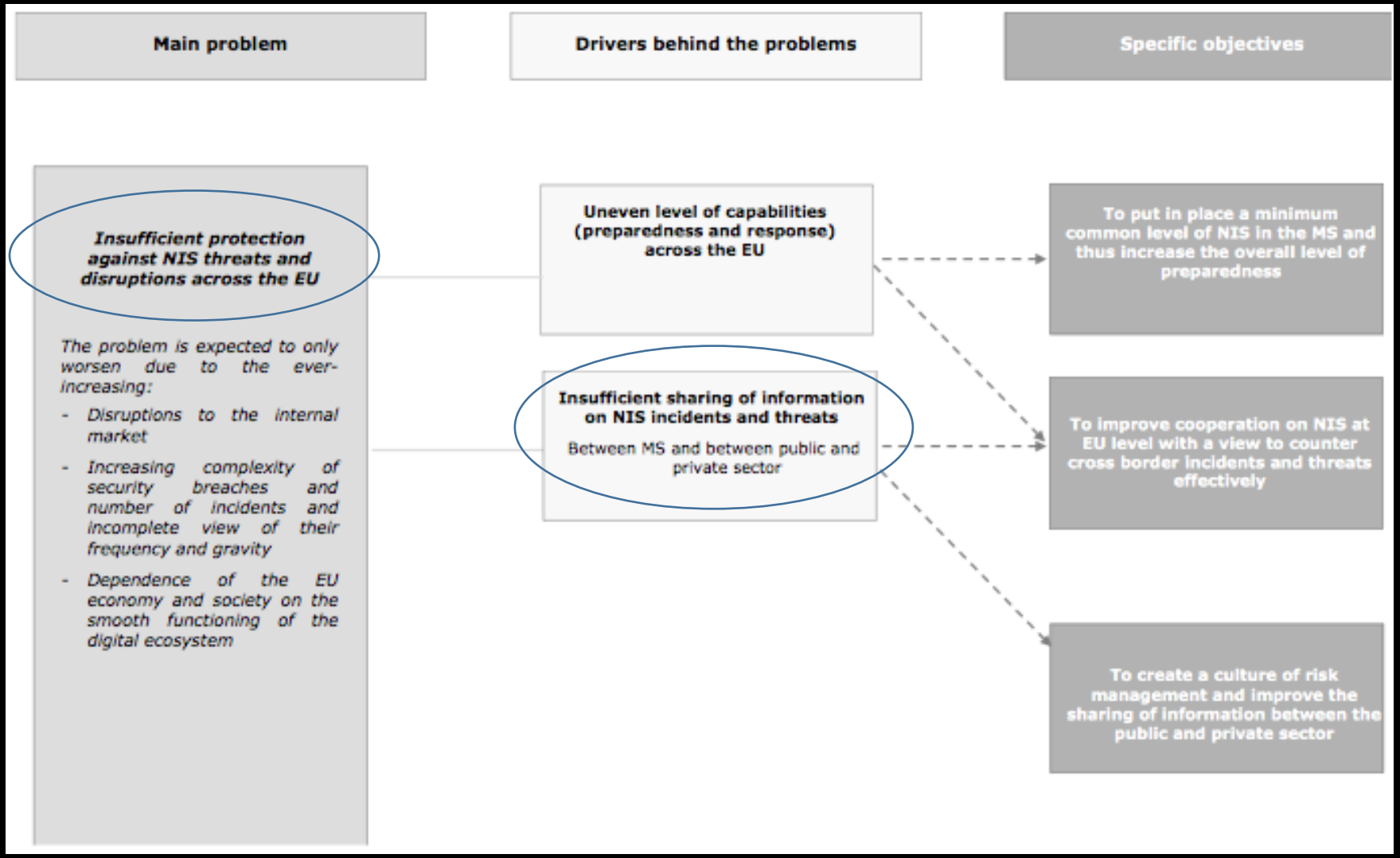
First steps to develop a CIIP EU policy

- **Initial emphasis on public-private cooperation**
  - The EP3R was a promising step, but was discontinued and replaced with the new NIS platform
- **Main initiatives**
  - 2008 ECI Directive
  - Review of the telecoms framework led to Art. 13a
  - ENISA's role expanded over time
- **Problems**
  - Wide divergence in definitions, standards, regulatory approaches
  - A largely under-developed (cyber)insurance market
  - Very diverse or lacking national strategies

Directive 40/2013

- **Member States shall take the necessary measures to ensure that they punish as a criminal offence (Art 3-7):**
  - Illegal access to information systems
  - Illegal system interference
  - Illegal data interference
  - Illegal interception
- **Includes incitement to commit such offences, and also failed attempts**
- **Imprisonment of at least two years, at least for cases which are not minor**
- **Monitoring and statistics provisions**

The NIS directive



The NIS Directive (I)

- **Article 6: every MS should establish a Competent Authority** (CA) that:
  - Monitors the application of the Directive at national level
  - Receives notifications of incidents from public administrations and market operators
  - Consults and co-operates with relevant law enforcement and data protection authorities.

- **Article 8: CAs should be connected via a secure network** (e.g. sTESTA) where they can circulate early warnings on risks and incidents , cooperate with the European Cybercrime Centre, etc.

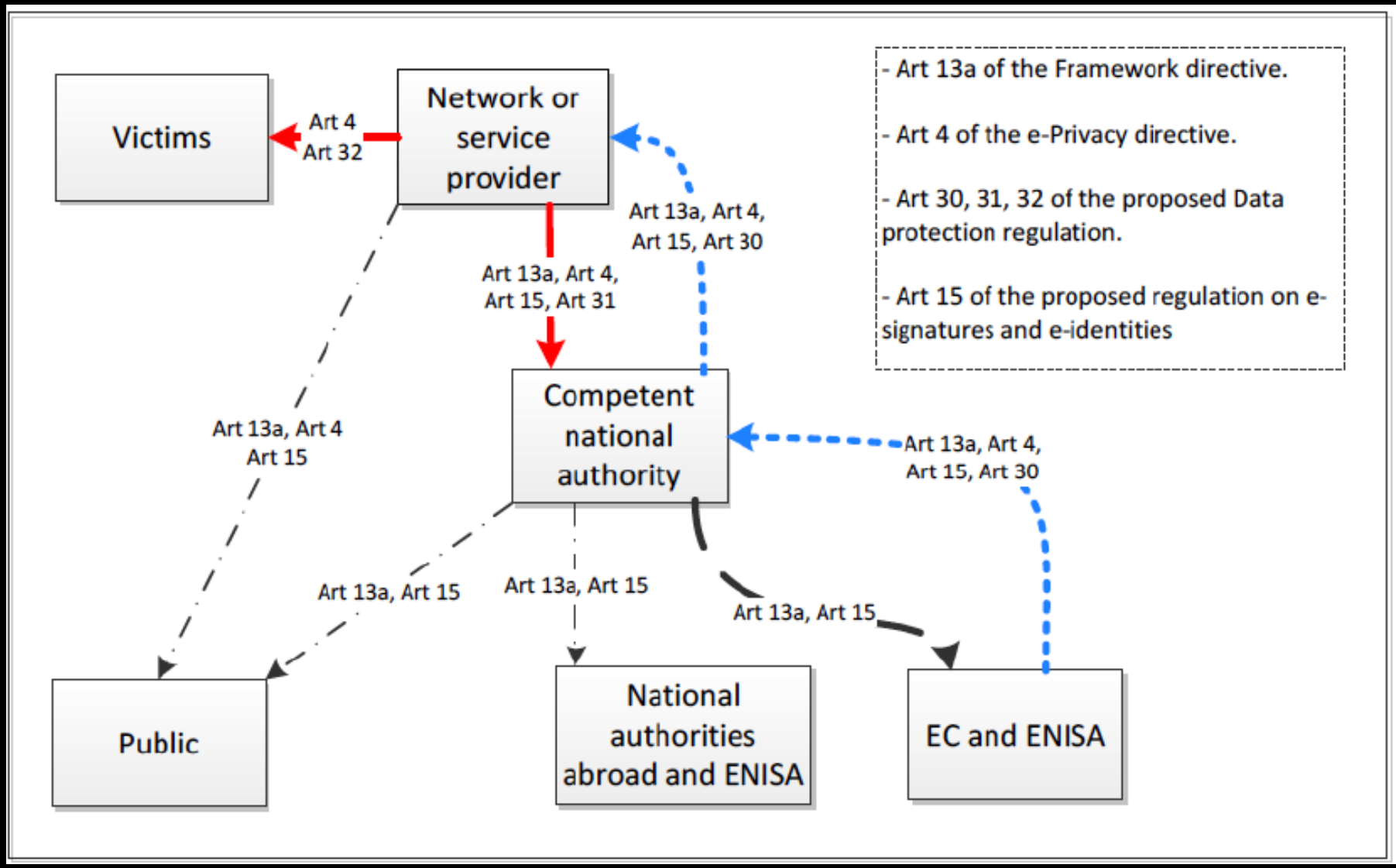
The NIS Directive (II)

- **Member States should establish CERTs responsible for handling incidents and risks that are to:**
  - monitor incidents at national level
  - provide early warnings and alert announcements
  - respond to incidents o provide dynamic risk management, incident analysis and situational awareness
  - build broad public awareness
- **CAs need to report early warnings of incidents or risks to the co-operation network where they:**
  - grow rapidly or may grow rapidly in scale
  - exceed or may exceed national response capability
  - affect or may affect more than one Member State.

An unprecedented notification system

- **An estimated 42,000 entities covered!!**
  - **Key Internet companies** (e.g. large cloud providers, social networks, e-commerce platforms, search engines)
  - **Banking sector and stock exchange**
  - **Energy (e.g. electricity and gas)**
  - **Transport (operators of air, rail, maritime transport, logistics)**
  - **Health**
  - **Public administrations**
- **Excluded**
  - **Network operators** (already notify under Art 13a)
  - **Hardware and software producers**
  - **Micro-enterprises**

A “web of notifications”



Affected businesses

	Energy		Transport		Banking and Financial services		Health		ICT		TOTAL excl. Public administration		Public administration
	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated turnover of businesses within the scope of the regulation	# of businesses within scope	Estimated operating expense of institutions within the scope of the regulation
	Mil EUR		Mil EUR		Mil EUR		Mil EUR		Mil EUR		Mil EUR		Mil EUR
Belgium	11.506	52	4.392	122	15.067	111	11.442	325			42.407	610	60.067
Bulgaria	36.510	165	2.423	57	1.607	29	959	227			41.498	478	5.657
Czech Republic	19.472	88	3.432	30	5.104	55	4.660	315			32.668	488	20.437
Denmark	20.578	93	5.896	480	12.960	158	11.164	166			50.598	897	68.262
Germany	352.705	1.594	85.723	3.260	132.353	1.966	79.186	2.452			649.967	9.273	327.560
Estonia	15.046	68	2.689	56	723	23	425	40			18.883	187	2.915
Ireland	3.540	16	3.754	40	21	81	0	134			7.316	271	27.495
Greece	2.213	10	10.017	3.033	12.374	62	0	339			24.604	3.444	35.841
Spain	87.844	397	19.448	414	61.891	357	39.938	1.380			209.122	2.548	181.161
France	39.829	180	42.328	671	107.961	768	77.173	1.877			267.291	3.497	382.675
Italy	94.482	427	28.966	830	92.350	806	0	1.810			215.798	3.873	271.753
Cyprus	885	4	736	57	2.171	214	422	24			4.215	299	3.829
Latvia	3.540	16	2.264	79	1.282	29	584	67			7.670	191	3.339
Lithuania	4.204	19	1.441	39	879	81	721	100			7.246	239	4.839
Luxembourg	3.319	15	1.063	15			800	15			5.182	45	4.950
Hungary	5.974	27	3.580	66	4.747	215	2.185	300			16.487	608	17.797
Malta	664	3	168	1	4		0	12			837	16	1.289
Netherlands	5.532	25	13.510	934	38.928	93	21.506	497			74.474	1.550	105.992
Austria	36.952	167	3.949	55	15.460	796	10.921	251			67.281	1.269	42.108
Poland	7.529	34	9.743	297	11.412	651	7.331	1.145			36.010	2.127	57.801
Portugal	7.081	32	3.257	229	11.762	178	6.138	319			28.237	758	27.232
Romania	18.587	84	11.212	244	4.327	42	2.728	644			36.853	1.014	18.451
Slovenia	5.532	25	1.051	57	1.129	25	1.262	163			8.974	270	6.881
Slovakia	12.170	55	3.144	28	1.901	26	1.396	61			18.611	171	7.944
Finland	26.110	118	7.578	329	7.197	358	5.200	161			46.085	966	48.090
Sweden	40.935	185	14.699	905	11.746	186	12.820	280			80.200	1.556	94.890
United Kingdom	13.276	60	67.735	2.028	180.732	396	0	1.860			261.743	4.344	412.600
EU 27	**876.009**	**3.959**	**366.509**	**14.596**	**731.129**	**7.736**	**298.961**	**14.967**	**30.000**	**1.374**	**2.302.608**	**42.633**	**2.241.853**

The U.S. policy on cybersecurity

The CISA (Oct 2015)

- Cybersecurity Information Sharing Act aims to “improve cybersecurity in the United States through enhanced sharing of information about cybersecurity threats, and for other purposes”
- The law allows the sharing of Internet traffic information between the U.S. government and technology and manufacturing companies.
- Any personal information which does not get removed during the sharing procedure can be used in a variety of ways. These shared cyber threat indicators can be used to prosecute cyber crimes, but may also be used as evidence for crimes involving physical force.

Homeland Security
Science and Technology

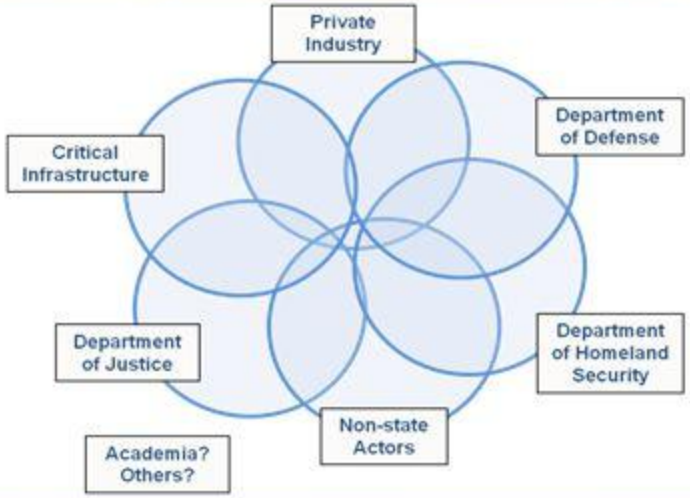
DHS Challenges for Cyber Security

Countering Threats

- Banking & Financial Fraud
- Sabotage & Attack
- Hacktivism
- Denial of Service
- Intellectual Property Theft
- Espionage
- Identity Theft
- Money Laundering
- Child Pornography & Exploitation
- Counterfeiting

Harmonizing Efforts

U.S. Federal Cybersecurity Operations Team
National Roles and Responsibilities



Building Capabilities

- Securing Federal Civilian Government Networks
- Protecting Critical Infrastructure
- Responding to Cyber Threats
- Combating Cybercrime
- Fostering Innovation
- Building Partnerships
- Growing & Strengthening the Cyber Workforce

Next Steps: Implementing Cyber Executive Order … Potential Congressional Legislation?

The Office of infrastructure protection (1)

- **Acts on three levels:**
  - Situational awareness in both normal, day-to-day operations and a crisis or event, including suspicious activity reporting, incident analysis, and recommended protective actions
  - Operational and tactical risk management actions in anticipation of and response to a threat to critical infrastructure at a specific location or across an entire sector
  - Strategic planning and investment to build capabilities that strengthen critical infrastructure security and resilience for the future

The Office of infrastructure protection (2)

- **Facilitates information sharing through:**
  - Alerts, threats, and warnings
  - Effective risk management programs
  - Collaboration and coordination
- **Information shared within a structured and secure information sharing environment helps critical infrastructure owners and operators guide investments, implement protective programs, and ensure effective response to infrastructure threats as they arise**

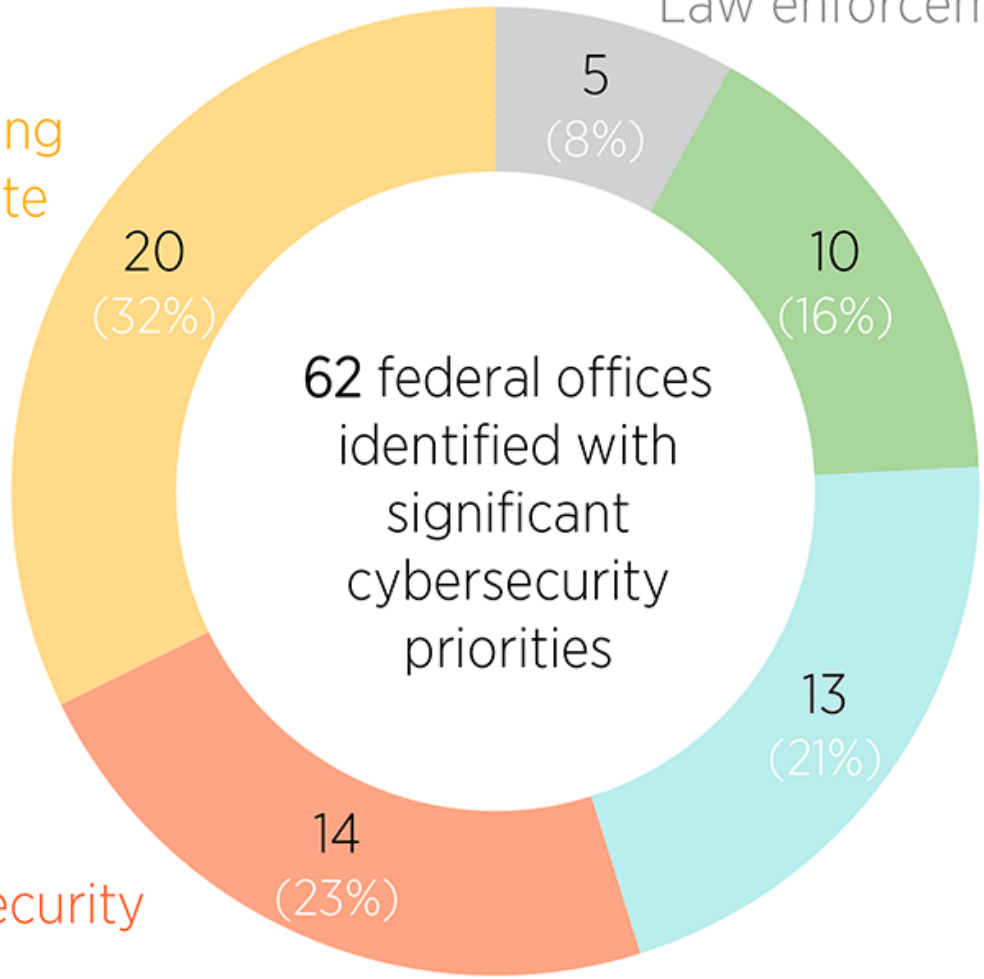
DHS Information Sharing system

- **The DHS has established several operations and tools to support information sharing within and among the critical infrastructure sectors. These include:**
  - Homeland Security Information Network - Critical Infrastructure
  - Infrastructure Protection Gateway
  - National Infrastructure Coordinating Center
  - Office of Cyber & Infrastructure Analysis
  - Protected Critical Infrastructure Information Program
  - Protective Security Advisors and Regional Directors
  - TRIPwire (Technical Resource for Incident Prevention)
  - DHS Daily Open Source Infrastructure Report

DHS Information Sharing system

- The DHS partners with other organizations to provide additional information-sharing support to its security partners. These include:
  - Sector-Specific Agencies (SSAs)
  - Information Sharing Environment
  - National Explosives Task Force
  - Fusion Centers in numerous states and large cities

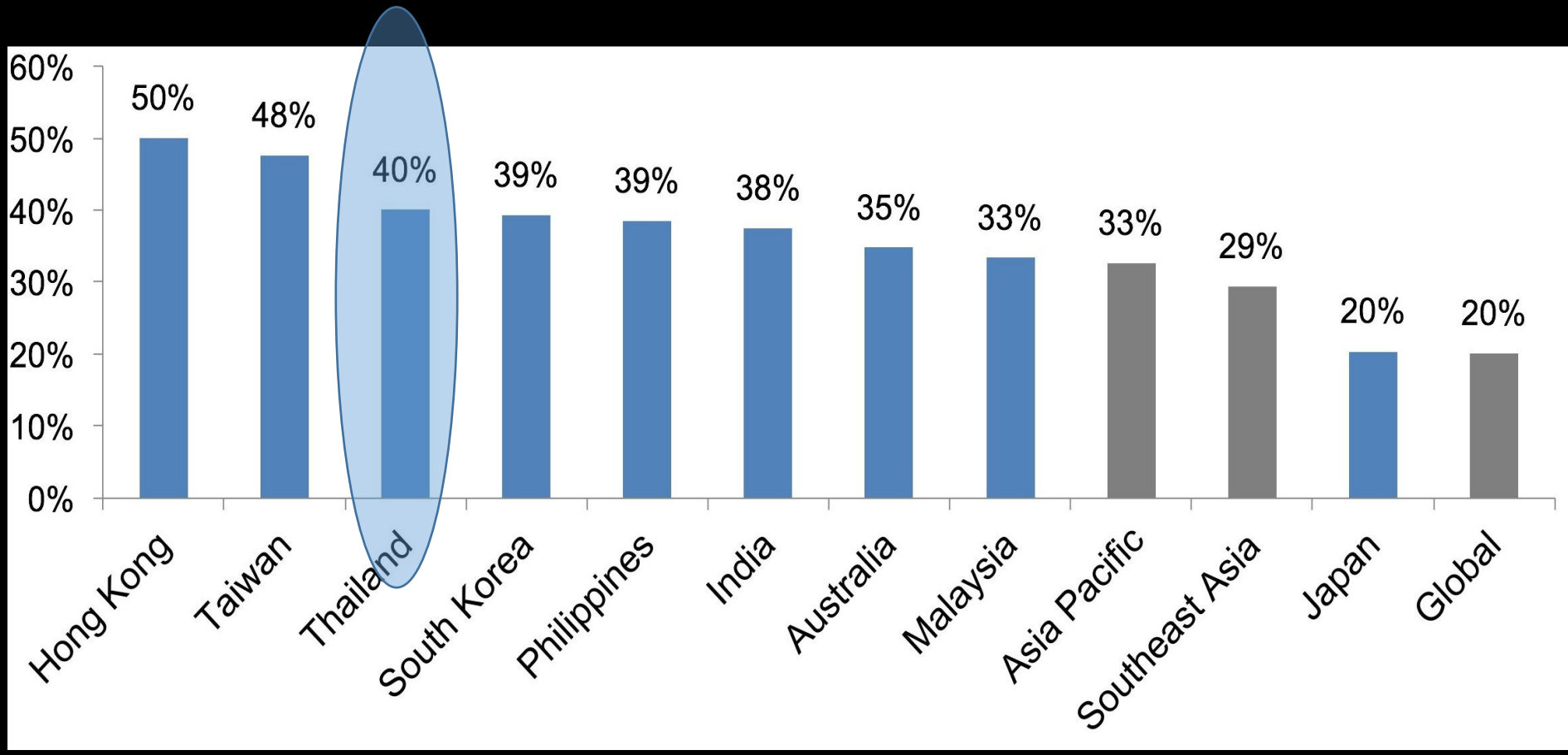
Federal Cybersecurity Centers by Mission Category, 2015



Sources: GAO, "Cybersecurity: National Strategy, Roles, and Responsibitilies Need to Be Better Defined and More Effectively Implemented," GAO-13-187, February 2013; Authors' analysis of federal websites and budget documents.
Note: lists of all offices and mission statements can be found in accompanying dataset.
Produced by Eli Dourado and Andrea Castillo, Mercatus Center at George Mason University, April 2015.

Cybersecurity in Asia

Exposure to APTs



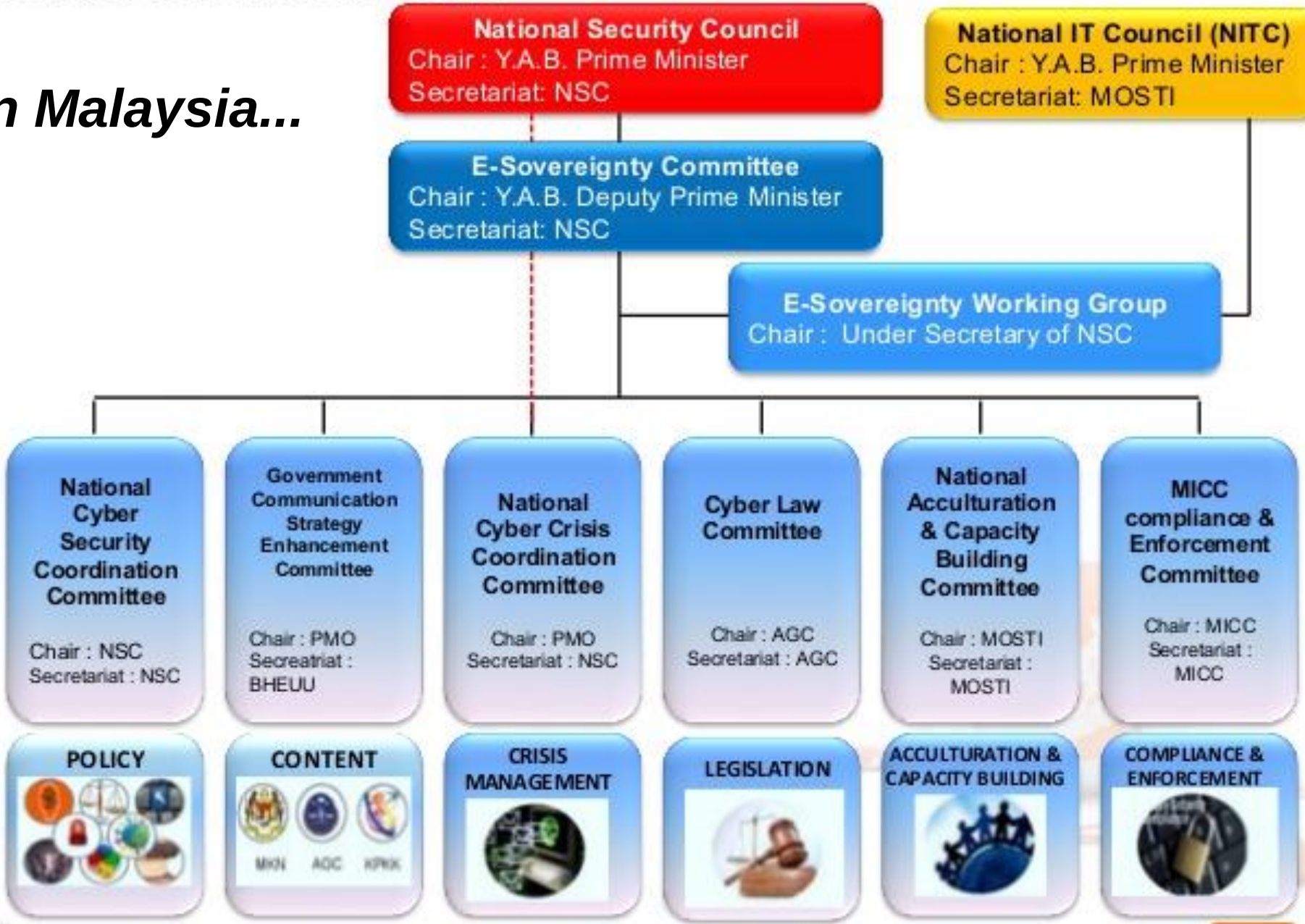
Source: FireEye (2015)

CYBER SECURITY HIERARCHY IN INDIA

PM OFFICE/ CABINET SECY (PMO/ CAB SEC)	MINISTRY OF HOME AFFAIRS (MHA)	MINISTRY OF EXTERNAL AFFAIRS (MEA)	MINISTRY OF DEFENCE (MOD)	MINISTRY OF COMMON INFO TECHNOLOGY (MCIT)	NON GOVT ORGANISATION (NGO)
NATIONAL SECURITY COUNCIL (NSC)	NATIONAL CYBER COORD CENTRE (NCCC)	AMBASSADORS & MINISTERS	TRI SERVICE CYBER COMMAND	DEPARTMENT OF INFORMATION TECHNOLOGY (DIT)	CYBER SECURITY AND ANTI HACKING ORGANISATION (CSAHO)
National Technical Research Org (NTRO)	Directorate of Forensic Science (DFS)	Defence Attaches	Army (MI)	Department of Telecom (DoT)	Cyber Society of India (CySI)
National Critical Info Infrastructure Protection Centre(NCIIPC)	National Disaster Mgt Authority (NDMA)	Joint Secretary (IT)	Navy (NI)	Indian Computer Emergency Response Team CERT-IN	Centre of Excellence for Cyber Security Research & Development In India (CECSRDI)
Joint Intelligence Group (JIG)	Central Forensic Science Lab (CFSLs)		Air Force (AFI)	Education Research Network (ERNET)	Cyber Security of India(CSI)
National Crisis Management Committee (NCMC)	Intelligence Bureau (IB)		Def Info Assurance & Research Agency (DIARA)	Informatics Center (NIC)	National Cyber Security of India (NCS)
Research & Analysis Wing (RAW)			Defence Intelligence Agency (DIA)	Centre for Development of Advanced Computing C-DAC	Cyber Attacks Crisis Management Plan of India (CACMP)
Multi Agency Center (MAC)			Defence Research Dev Authority (DRDO)	Standardisation, Testing and Quality Certification (STQC)	
National Information Board (NIB)					

ORGANIZATION STRUCTURE

In Malaysia...



Indonesia's new cybersecurity strategy

Source: Dr. Muhammad Imam Nashirudin, "Indonesia National Cyber Security: Towards a Holistic Approach" August 2015

Thailand: the need for a whole of government approach

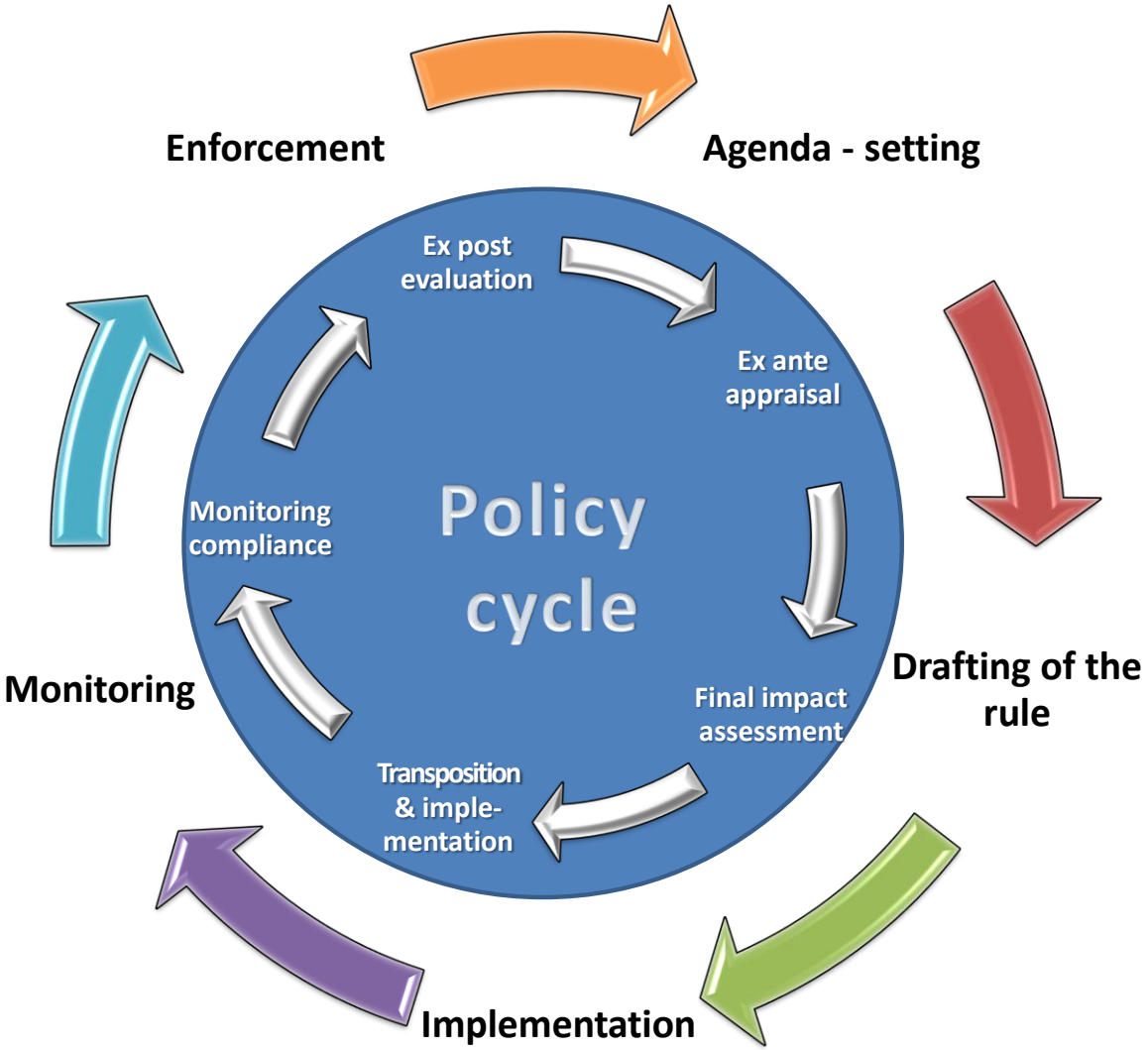
- "Within-government" collection and info sharing
- Exchange of information with private sector and state-owned enterprises
- Preparedness and awareness
- Risk prevention, assessment, mitigation
- Education policy efforts
- Mix of horizontal policies and sector-specific policies (e.g. ETDA)
- Strengthen/multiply CERTs and create sharing platforms
- Regional cooperation (e.g. MyCERT, HKCERT)
- Technology forecasting: anticipate developments to the extent possible

Session 7

The modern regulator: adaptive policymaking for the Internet era

Bangkok, 4 May 2016

The “policy cycle”



Introduction: the roots of RIA

- **RIA was introduced in 1981 in the US**
  - **Preceded by a long, fierce debate on the role of efficiency criteria in policymaking (Renda 2011)**
  - **Purpose was to control the bureaucracy and improve the business climate (Posner 2001; Livermore 2014)**
  - **The ultimate scope of CBA in RIA was rather narrow, and remains narrow notwithstanding proposed reforms**

IA: Main Steps

Analysis of status quo

Identification of need for intervention (including at EU level)

Analysis of alternative options

Consultation

Collection of information

Identification of preferred option

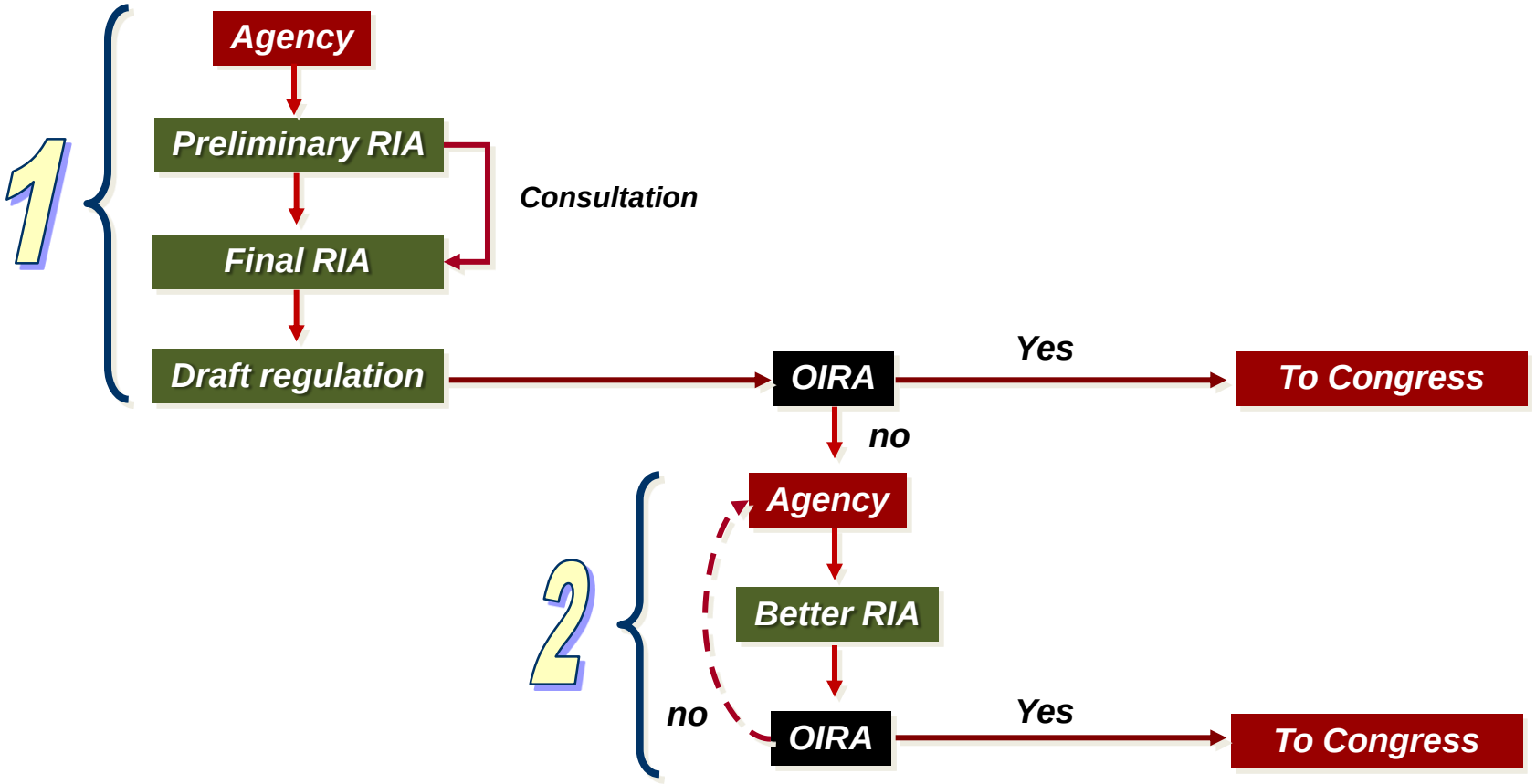
Monitoring and evaluation indicators

Input to drafting

RIA in the US (1)

- **1981: Reagan administration introduces RIA (EO 12,291)**
  - ***Does not apply to independent agencies (e.g. FTC, FCC, SEC)***
  - ***Estimated yearly saving: $10 billion***
- **1993: Clinton launches the NPR (EO 12,866)**
  - ***Threshold for RIA: only "significant regulatory actions"***
- **2002: RIA under George W. Bush (EO 13,258)**
  - ***Removal of Vice-President's role in solving controversies***
  - ***OIRA Prompt letters: from "consultant" to "adversarial gatekeeper"***
- **2009: RIA under Obama (EO 13,653)**
  - ***Cass Sunstein and the "nudge" era***
  - ***Cumulative costs, interactive costs, etc.***
  - ***The Shelanski era?***

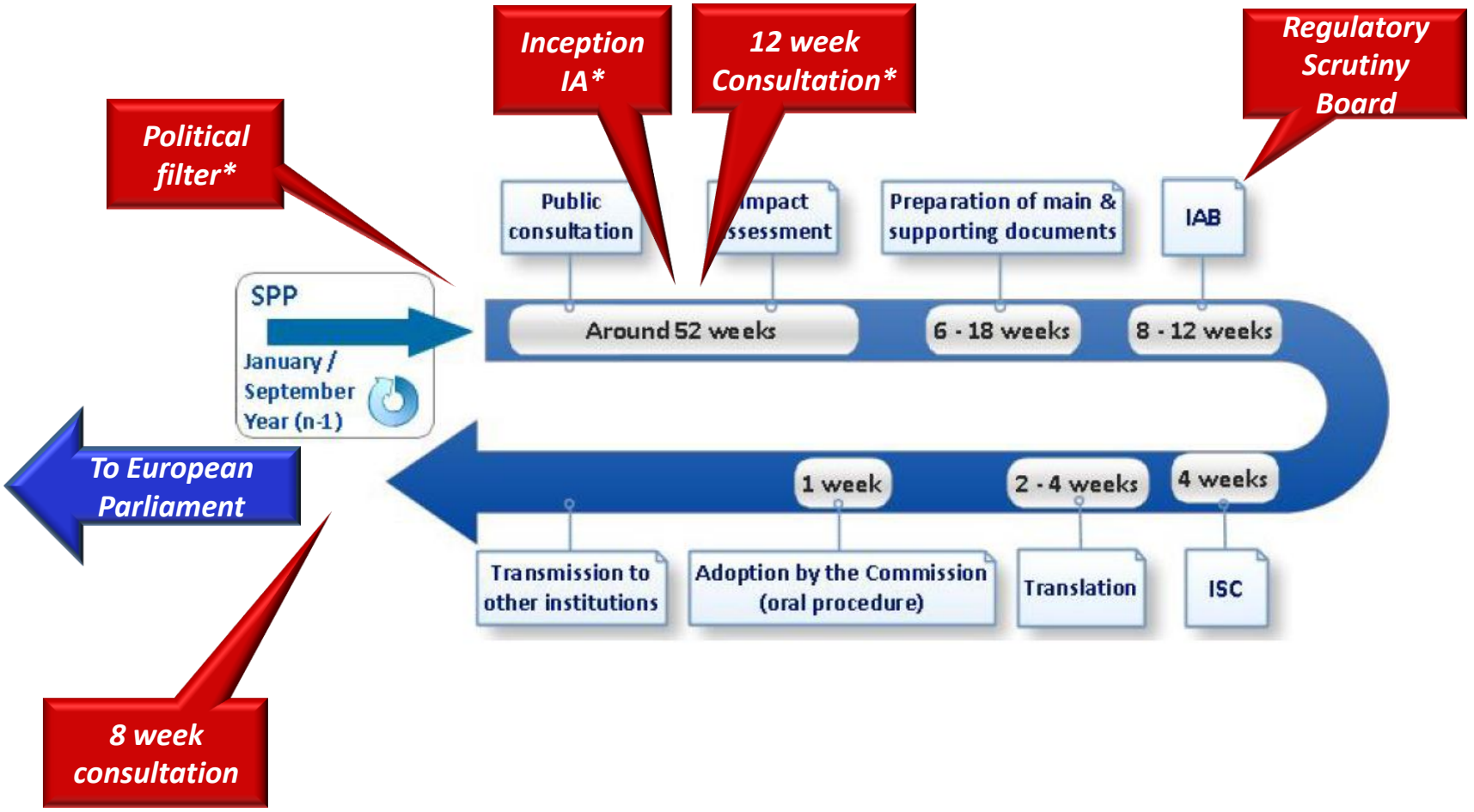
RIA in the US (2)



Impact Assessment in the EU

- **2002: communication on Impact assessment**
- **2003: Inter-institutional agreement on better lawmaking**
- **2005: Re-launch of the IA system (“growth and jobs”)**
- **2007: Impact Assessment Board**
- **2010: Communication on smart regulation**
- **2012: European Parliament creates an IMPA Directorate**
- **2012: REFIT strategy**
- **2014: Commission Vice President for better regulation**
- **2015: RSB + New Better regulation Package**

Changes in the EC policy process



** For "major" initiatives*

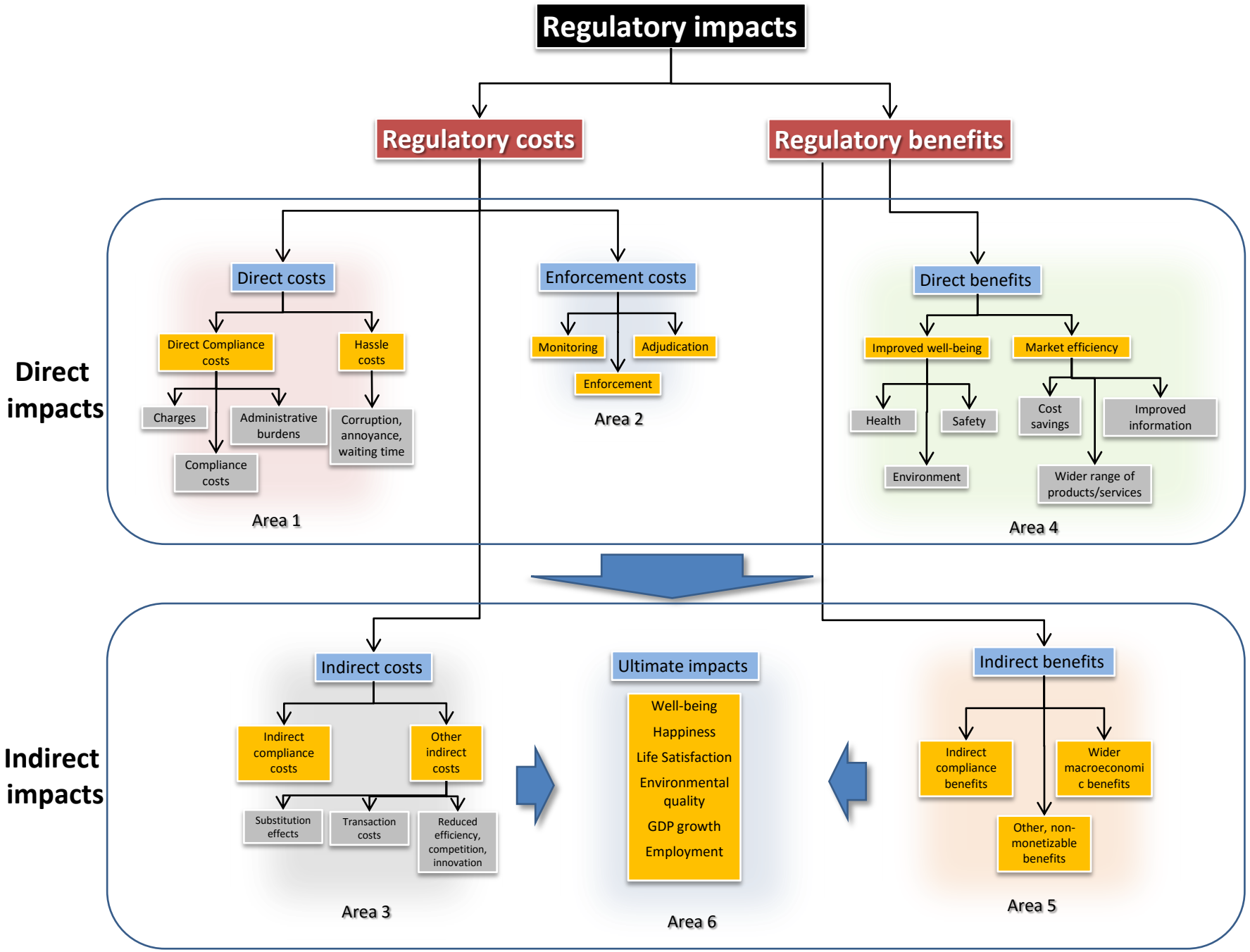
RIA in the ICT sector: examples

- **Leading countries**
  - **UK (OFCOM)**
  - **European Commission**
  - **US FCC (cost-benefit analysis)**
- **Examples of RIAs**
  - **EU Roaming regulations**
  - **Australian RIS on lot design for clearing the digital dividend**
  - **Qatar's RIA on the QoS for telecommunications**

RIA in the ICT sector: checklist (2)

1. What is the policy problem, if any?
2. Is it a market failure or a regulatory failure?
3. What are the main drivers of the policy problem?
4. Who is affected by the current situation?
5. What might happen if no policy action is undertaken?
6. What would happen under the “zero option”?
7. What alternatives would possibly address the problem?
8. What direct costs will be generated by the alternatives?
9. What are the benefits expected from the alternatives?
10. What are the likely indirect impacts of alternatives?
11. What is the appropriate criterion to compare alternatives?
12. What are the major risks?
13. How will the regulation be monitored and evaluated?

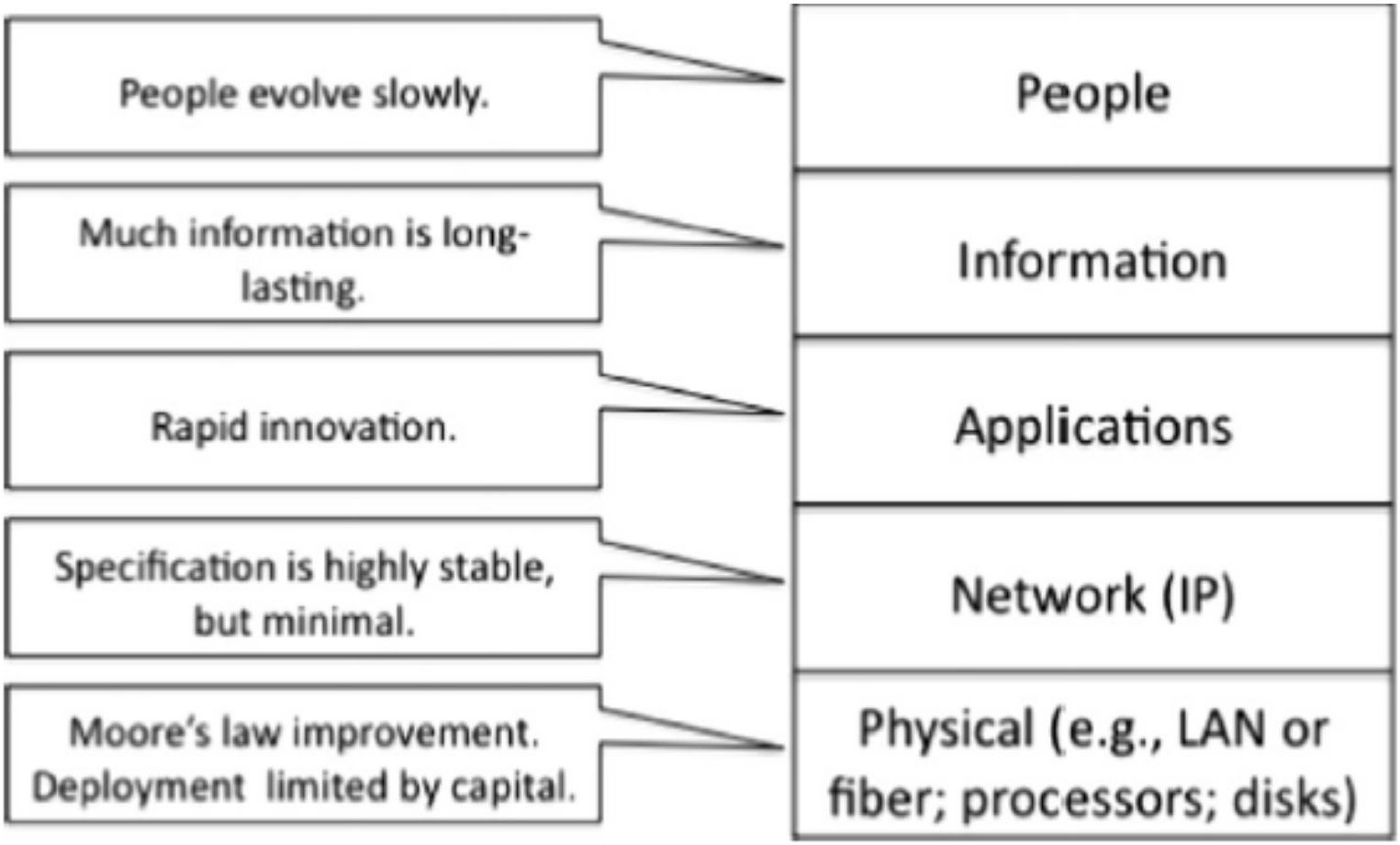
A taxonomy of costs and benefits of regulation



Source: Renda et al. 2014

Peculiarities of Internet Policy

Layers and speed



Source: Clarke and Claffy (2015)

From foundations to policies

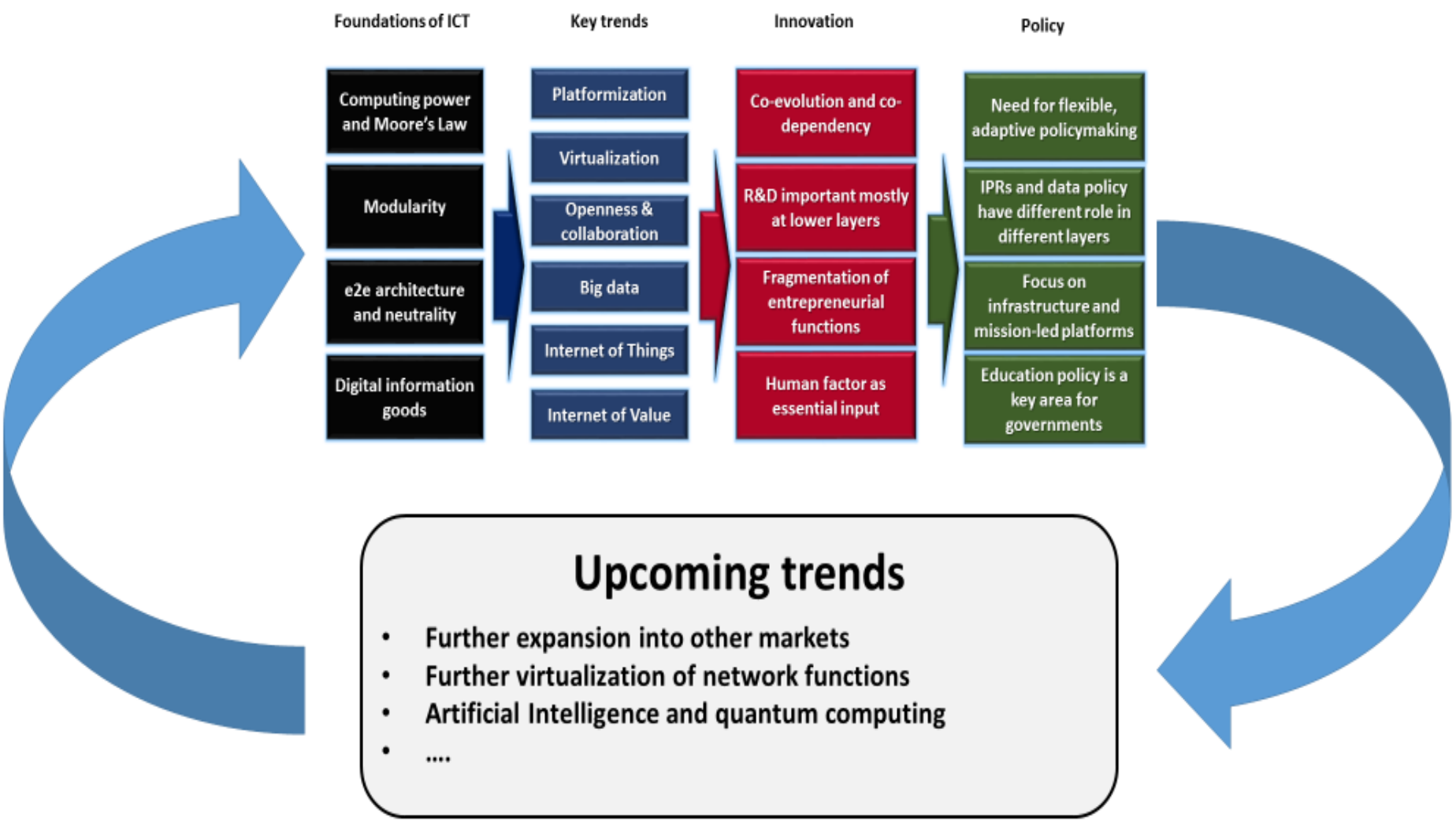
Foundations of ICT

- Computing power and Moore's Law
- Modularity
- e2e architecture and neutrality
- Digital information goods

Future trends to be expected

- **Further expansion**
- **Further virtualization**
- **Robotics and cyber-physical smart objects**
- **Deep machine learning and smart algorithms**
- **…**

“Laws that learn”



Consequences for policy

- **Need for more flexible, effective policymaking**
  - E.g. “Regulatory Sandbox” approach in the UK, planned adaptation in the European Union
  - Not just red tape: avoid incumbency problems and set rules that are fit for data-driven innovation
  - Cooperate and engage with platforms: avoid the neutrality/responsibility problem
  - Fix “horizontal” policies, fine-tuning them to the different layers
  - Incorporate technology roadmaps and cyber-risk assessments as inputs in the policymaking process
  - Ongoing monitoring of policy impacts, including through open government techniques

Session 8

Wrap up and discussion of policy recommendations for the NBTC

Bangkok, 4 May 2016